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Evening Meeting.

Monday, June 14, 1875.

Admiral Sir HENRY J. CODRINGTON, K.C.B., in the Chair.

NAMES OF MEMBERS who joined the Institution between the 1st and 14th  
June, 1875.

ANNUAL.

Hewett, Edwd. O., Major, R.E.

Reece, Fredk. L. C., Lieut., R.N.

MANCE'S HELIOGRAPH, OR SUN-TELEGRAPH.

By SAMUEL GOODE, Esq.

THE duty I have undertaken this evening of offering a brief explanation of the construction and use of the Heliograph would have devolved more appropriately upon its inventor, Mr. Henry C. Mance, of the Government Persian Gulf Telegraph Department, but as he is on service in India, and is consequently prevented from appearing before you, I have been induced to attempt it for him. Beyond the fact that the invention has been placed by Mr. Mance in my charge, and that I have had some practical acquaintance with its working capabilities, there is nothing to justify me in addressing an assembly like the present on a subject in which so many purely military questions are involved. I have, however, been put in possession of the results of the numerous experiments made by Mr. Mance, and have had the further advantage of reading the reports of the several skilled officers to whom the instrument has been entrusted for trial by the Government of India. It is upon the facts embodied in these reports that the suggestions I may venture to offer as to the adaptability of the instrument to military uses are chiefly based, and if I travel into further inferences, I beg you to regard them as submitted to the consideration of those of my hearers who may do me the honor to refer them to the test of their own knowledge and experience. My chief encouragement lies in the hope that the merits of the instrument will in some measure make up for all defects in its description. I should have no doubt on that point if this meeting had been assembled on a clear sunny after-

noon on Dover cliffs to conduct a conversation through its instrumentality with another party similarly equipped at Calais. To those who have not studied the phenomena attending the reflection of sunlight, first experiments with the heliograph could not fail to be interesting. The most astonishing of them is the immense distance at which the flash can be seen, bright and distinct as a planet, which in appearance it very much resembles. Many of my hearers will scarcely be prepared to credit that signals from the smaller of the instruments before them, which has a mirror of  $4\frac{1}{2}$  inches diameter, are clearly visible under favourable atmospheric conditions, without the aid of a telescope, at 25 and 30 miles; while from mirrors of 8 and 12 inches they are equally clear at 50, 80, and even 100 miles. The fact is so startling when brought home to one by experiment, and in combination with an apparatus by which the flashes can be truly directed, and so made to appear and disappear as to represent words, that the judgment is liable to fall captive to the imagination in forming an estimate of its practical value. For here is an instrument giving any person of intelligence the power, after a few hours' instruction, of transmitting messages at a rapid rate in any direction and to any distance, which is in fact a complete telegraph without batteries or wires, as portable as a rifle, and only about half its weight.

Experience soon shows, however, that on ordinary occasions its utility is greatly circumscribed by the necessity of two conditions which do not always exist, especially in a climate like that of England, viz., the presence of sunshine and the absence of obstacles between the points of communication. But before entering on the advantages or disadvantages attending its use, I will ask your attention to the construction of the instrument.

The heliograph consists of a mirror mounted on a suitable stand, with adjustments to revolve and incline it so that the sun's rays can be reflected with ease and precision in any required direction. The horizontal movement is obtained by a tangent-screw in contact with a wheel, on the axle of which is also a revolving plate carrying the mirror; the vertical inclination is altered by screwing a steel-rod through a nut attached to the top of the mirror. Both adjustments are so constructed as to admit of the reflection being thrown at once approximately true, then absolutely so, and so kept, notwithstanding the ever changing position of the sun. By pressing the tangent-screw outwards it is removed from contact with the wheel; the plate is then revolved freely by the hand to the required place. The rod attached to the top of the mirror, slides into a cylindrical handle at the back, until the desired elevation is attained; it is then clamped, and by a slight movement of the tangent-screw or the rod, the lateral or vertical inclination of the mirror can be adjusted to the utmost nicety. The cylindrical handle is connected by a ball-socket-joint with a lever attached to the revolving plate, so that the lever handle and rod together form a finger key. The depression of this key slightly alters the inclination of the mirror, which is restored on the pressure being removed by a spring beneath the lever. Thus by the action of the finger-key the reflection of the mirror can be thrown on and off any



given spot, and by varying the duration of the pressure, the flashes are made long or short. By combining these long and short flashes, which are equivalent to the dashes and dots of the Morse Code, the letters of the alphabet are indicated, and the transmission of verbal messages is made possible. Good signallers can send them at the rate of twelve or fifteen words per minute. A very simple means is adopted to ensure the flash being directed truly. It will be observed that a small portion of quicksilver is removed from the centre of the mirror, giving it the appearance of having a hole in it. Through this the signaller looks toward the station with which he wishes to communicate, while a sighting rod is set up about ten yards before him in a true line with it. A metal stud, answering to the sight of a rifle, is then slid upwards or downwards on the rod until the centre of the mirror, the stud, and the distant station, are truly aligned. This done, however much the mirror is revolved, the alignment is never disturbed, inasmuch as the centre, being the axis on which it moves, is stationary. It follows as a matter of course that when the flash from the mirror is thrown on the stud it is in a right line with, and is visible from, the station beyond, at which it is directed. The signaller has therefore only to take care that the flash rises to the stud every time the finger-key is depressed. The observer has merely to look towards the signalling station, when a succession of bright starlike appearances meets his gaze, which he can readily interpret into words. On the sighting-rod slides also a short cross bar. It is placed at the same distance beneath the stud as the pressure of the finger-key rises the flash on the rod, and so that, when the mirror is at rest, the flash falls on the bar, its centre coinciding with the point of intersection. As the position of the sun alters, the flash would gradually move from this central position, to which it must be preserved by a slight turn at intervals of the tangent-screw and vertical adjustment. The rod thus serves as an object on which to throw the flash, and thus of ascertaining its whereabouts; it also affords a means of directing the flash truly. Both rod and bar are usually made of white wood, the reflection being more visible on a white than on a dark substance.

It is evident that if it were required to send the flash in a direction precisely opposite to the sun, a difficulty would arise, but it is easily obviated by employing a second instrument, its function being to reflect the rays back into the first, which then flashes them to the required spot with as much ease as if no intermediary had been employed. A second apparent difficulty—that of making a true alignment with a station twenty or fifty miles off—has in reality no existence. It is easy to attract the attention of a look-out, however distant; he responds with a rightly directed flash from his instrument, and at that starlike appearance, the original signaller aims with as much ease as he would at the moon.

It may be added, that as the vertical adjustment forms part of the finger-key, the movement necessary to obviate the changing position of the sun can be made while in the act of signalling, one hand being also at liberty to control the tangent screw.

The next subjects on which, I think, you will desire some further

assurance will be, first, the range of the signals, and secondly, their intelligibility. The official reports are very explicit on both particulars. And here I must explain that Mr. Mance, being on service in the Bombay Presidency, brought his invention as early as 1869 to the notice of the Government of India, who submitted it to every form of practical test. In a letter, dated 16th April, 1873, Colonel Roberts, C.B., V.C., Quartermaster-General, writes, "I am directed by the Right Honorable the Commander-in-Chief, to submit, for the information of Government, a printed copy of a memorandum, embodying the results of the several experiments and trials which have been made to test the efficiency of the heliograph invented by Mr. Mance, as a means of signalling for military purposes. The Commander-in-Chief is satisfied that the instrument even in its present form" (it has been vastly improved since then) "would, under certain circumstances, and where the electric telegraph is not available, prove of great value in the field, and His Excellency is of opinion, that six or eight heliographs should be made and stored up with the field telegraph train at Roorkee, some men of the sappers and miners being kept constantly practised in the use of the instrument," and while "His Excellency does not consider the heliograph would be substituted for flags," he observes, that "it is an instrument adapted for a special end, and as such is extremely valuable." With respect to the two questions of range and distinctness, the memorandum above referred to says, "All the reports agree in the following points: (a) that the signals given by it are perfectly clear and satisfactory; and (b) that they can be easily read in ordinary weather without telescopes up to 50 miles."

The capabilities of the heliograph are therefore thoroughly established. My desire, this evening, is to draw attention to the subject of sun-flashing generally, and to show how well its study will repay Officers, especially those on foreign service, by whom the heliograph can be made available, not only in cases of emergency to which they are always exposed, but in their every-day life. I am informed that a Staff Officer at Poona, who had a country house about twenty miles distant, used, when there, to go by appointment at a fixed hour to a certain window to receive and reply to messages flashed to him from Poona, and so conducted his official business. This is but one illustration of the adaptation of the instrument to daily requirements; it is not difficult to divine the thousand and one purposes it might be made to serve at a detached Indian hill station, by uniting it with surrounding stations and the plains. But to return to the memorandum, bearing the signature of Captain Collette, D.A.Q.M.G.: "Messages can, under favourable conditions, be signalled distances up to 50, 80, or even 100 miles, without using telescopes. Even during very hazy weather signals from Shaik Bodeen were quite distinct to the naked eye at Dehra Ismail Khan, a distance of 38 miles, although the hill itself was barely visible. With telescopes and suitable mirrors (6 or 8 inches) there seems to be hardly any limit to the distance at which signalling could be carried on." A little consideration will convince us that the latter remark is no exaggeration. The sun's light reaches us through say

92,000,000 miles, whether a million or two more or less the *savans* who recently observed the transit of Venus will perhaps shortly decide for us. Is it too much, then, to believe that after such a journey, the rays preserve sufficient vital force to carry them a hundred or two miles further? Striking a mirror simply alters their course, bends them to a new direction, but makes little difference to their energy. We have a practical illustration of the fact in the moon, which, though not perhaps the best reflector, projects the sun's rays to us from a distance of 232,000 miles. The planet Neptune is three times the distance from the sun the earth is, yet the solar rays reach it and are reflected back to us. Abundant illustration of the immense distance at which reflected light can be seen might be afforded from terrestrial objects, but it is, I feel unnecessary.

The knowledge of the potency of sunlight as a signalling agent is at least as old as Alexander the Great, whose fleet is said to have been guided along the Persian Gulf by mirrors, during his invasion of India. I am informed on good authority that signalling by sun-flashes is practised by the Indians on the North American prairies to this day; and the Russians had recourse to it during the siege of Sebastopol in 1854-5. But from Alexander of Macedon to Alexander of Russia little progress was made in this kind of telegraphy; indeed it had fallen into disuse, when, towards the close of last century, General Roy employed it in the operations he conducted to connect the meridians of Paris and Greenwich. Out of those measurements sprang the great trigonometrical survey of the United Kingdom, but recently completed. During the early periods of that survey, it was customary to burn Bengal lights or Argand lamps, at night, on the distant points of which the bearings were required. The very limited range thus obtainable, and other practical difficulties, led that very ingenious officer, Captain Drummond, R.E., to an adaptation to survey work of what is now known as the lime-light; and so efficacious was it found, that during the survey of Ireland, in 1825, a range of 66 miles was obtained from Slieve Snaght, in Donegal, to Divis Mountain, near Belfast. But a far more powerful agent than the Drummond light was about to be called into service. The manner in which General Roy employed reflection is not recorded, but in 1822-3, Colonel Colby, R.E., who was then conducting the survey, devised a sun-flashing instrument, which, though exceedingly primitive, was attended with much success. It consisted of a stout plank, on the face of which was nailed, one below the other, several plates of polished tin, at angles calculated to reflect the sun's rays for a considerable time in the same direction, notwithstanding his apparent movement. The idea of sun-flashing being thus revived, Captain Drummond's inventive powers were brought to bear, and he succeeded in producing an instrument far more effective for the purpose than Colonel Colby's tin plates. Taking a plain mirror as a reflector, he devised means for adjusting it to any position, and, by a combination of telescopes, of directing the flash truly. This highly ingenious, but delicate and complex, instrument he called a heliostat. Its power was marvellous; the Surveying Officers were enabled by its means to make their observations at three times the distance they could previously,

with much greater ease, and with far less liability to error. It was soon found possible to reduce the complexity of the instrument; the telescopes were dispensed with, and other modifications made, until it assumed the form it has ever since retained, which, though comparatively simple, still requires an expert with a theodolite to direct it. How far these modifications were influenced by the heliostat invented about the same time by Professor Gauss, and employed by him in the survey of Hanover, I am unable to say; but what the heliostat then became it has ever since remained. Its function is to throw a steady flash of light between distant points, to enable surveyors to take their relative bearing, and for this purpose it has been in constant use in all great trigonometrical surveys throughout the world. The map, issued to illustrate the survey of the United Kingdom, shows the hundreds of triangulations which were made by means of the heliostat in the course of that operation. Many of the points of observation are from 60 to 100 miles apart; and in the case of the triangle formed by Scaw Fell in Cumberland, Slieve Donard in Ireland, and Snowdon in Wales, the sides are 111, 108, and 102 miles respectively. This fact is worth bearing in mind in connection with the range of sun-flashes in northern latitudes.

The heliostat is, however, in no sense a talking instrument; it is neither designed nor employed for that purpose, although the strong desire of facilitating operations by communicating with their distant colleagues has doubtlessly led surveyors occasionally to the expedient of making pre-arranged signals to each other. The heliostat had been in use nearly half a century when the happy thought occurred to Mr. Mance of converting rays of light, which had previously been regarded in a signalling sense as entirely passive, into active speaking agents. This he did by adapting to a mirror, mounted somewhat similarly to the old heliostat, a means of imparting to the reflections the character of pulsations of varied duration, in accordance with the Morse code. In fact, in furnishing his instrument with a finger-key, he gave it a tongue capable of distinct and effective utterance; he also found it a language in which to speak, the Morse code. As the celestial bodies have already been used as illustrations, I may refer to them again. The difference between a heliostat and a heliograph is the same in principle as if the moon, instead of the steady reflection she has hitherto given us, were to make her light intermittent, sending it at short, well-defined intervals, in deference to a sudden desire on the part of the man, her occupant, to communicate with sublunary mortals through the medium of the Morse code. The heliograph is, however, as applicable to all forms of survey work as the heliostat, besides being adapted to verbal intercourse.

Whether the means adopted by Mr. Mance for directing the flash of a mirror, and converting it into articulate language, is the best that can be employed, time will show. Other forms will doubtlessly be attempted, with which other names may be associated. It is seldom that an invention springs into life absolutely perfect. It is due to Mr. Mance, therefore, to call attention to the fact that, until the appearance of the heliograph, no effective speaking, sun-flashing instrument was known to the world. In proof of this, it is only

necessary to refer to the important crises which have passed without its employment. To take a recent example. If the heliograph had been in use in the French Army during the siege of Metz, it would have been possible for Marshal Bazaine to have kept up communication with the Armies in the field operating for his relief, despite all the efforts of the besiegers; and had this been done it is certain that, whatever other fate may have befallen France, she would at least have been spared the disaster at Sedan.

In case of siege, the heliograph possesses one marked advantage over the electric telegraph. The latter is certain to be rendered inoperative at once by the destruction of the wires. The heliograph is liable to no such interruption. The limit of its range is dependent only on the elevation at which it can be placed. It can signal to any and every spot round the compass in succession over the heads of the besiegers, who are not only powerless to intercept it, but might not be conscious of its existence, as the flashes cannot be seen a little distance from the true line. It may be observed, too, that signals can be sent into a besieged city as easily as out of it, a result not obtainable by pigeons and balloons. The heliographic conditions were not so favourable at Paris as at Metz, but if communication could have been established between the city and General Chanzy, when he approached so near to it with the Army of the Loire, it is next to certain the siege would have been raised. Again, during the Sepoy mutiny, what a consolation would it have been to the devoted garrison of Lucknow to have been informed of the approach of the gallant Army which ultimately fought its way to its relief, and also to that Army to have known how long the garrison could hold out. The mutual assurance could have been given by the heliograph with ease. In fact, a much simpler instrument than the heliograph would have sufficed. The requisite flashes could have been sent by an ordinary hand mirror, as they could also have been sent at Metz and Paris. But the thought of converting the sun's rays into speaking messengers had not then been born. It was much easier to find a hero, like Kavanagh, ready to risk the most horrible of deaths in making his way through the myriads of relentless foes surrounding the city, than to call into existence a new mechanical agency. Next to the invention of the heliograph itself, the most important service rendered by Mr. Mance has been the persistency with which he has advocated the use of sun-flashing in connection with the Morse code, until at length the attention of the Indian Government, and of signalling Officers generally, has been thoroughly roused, and in new emergencies it will not, I feel assured, be forgotten.

But, without looking farther into the past for illustrations, which every Officer who has been on active duty will be able to supply, I may refer to the vital importance that would attach to the heliograph in case of another mutiny or general uprising of the population in India. The first attempt of the insurgents would be a general cutting of wires and tearing up of rails throughout the country. The fighting value of the comparatively few British forces scattered over India depends, in no small measure, on the existence of easy means of communication between the different military stations, thus knitting the

detached corps together, giving them timely warning of danger, and common action against their enemies. With telegraphs destroyed and garrisons besieged, unanimity of action would be impossible. Over such a vast area as India flag-signalling can be of little value, but a well developed heliograph system would preserve to the forces an inalienable power of holding rapid communication from one end of the country to the other. I need not say that the instrument which could ensure this, in such a crisis, would be priceless, and the possibility of the contingency arising, would in itself seem to justify the training of the signalling corps at home and abroad in its use.

The value of the heliograph is, however, by no means confined to great and rare emergencies. The tripod instrument before you, which weighs, with cases and stand complete, but 5 lbs., has been constructed with special reference to ordinary service in the field. "It is of great importance," says Sir Garnet Wolseley, in the *Soldier's Handbook*, "that outposts should be able to communicate by signals with the main body, and that officers in charge of patrols, reconnoitring or flanking parties, advanced or rear guards, should have the power of rapidly communicating with the General what they observe, or the intelligence they may obtain." The question to be determined is, whether the heliograph does or does not afford additional facilities for securing that communication, on the importance of which Sir Garnet insists. I use the word *additional* advisedly. There is no desire whatever to depreciate or displace any of the signalling agents at present employed. On the contrary, great pains have been taken to render the heliograph so light, handy, and portable, and so little subject to damage, that it may be added to the present signalling equipment without being felt as an incumbrance. The possibility of its extraordinary powers being called into requisition, might be thought to justify its being taken into the field on all occasions; but if the conditions were not favourable, the signalling means at present employed could still be used.

There are circumstances under which none of the existing systems are applicable, yet which the heliograph would meet. It may be well, however, to say here a few words respecting the radical defects of sun-flashing and of visual signalling generally. "What is the good," it may be asked, "of expatiating on the merits of an instrument, the use of which depends entirely on the presence of the sun. In England sometimes the sun does not shine for weeks together, and when it does, just at the moment a signal should be made, a cloud would possibly obscure it, or some intervening object prevent the flash from reaching its destination?" To such objections I would reply that the heliograph is not put forward as an independent or perfect signalling instrument. The telegraph, though by far the most valuable of all signalling agents, is far from being perfect. "The electric telegraph is constantly liable to interruptions in war," writes the distinguished authority before quoted, and I may venture to add, it is costly in money and men to produce, transport, lay and protect when down. Hence, and because it can only signal in the direction of the wires, its use in the field is very circumscribed, being employed in none of the operations before mentioned as the objects of signalling.



It is essential, therefore, as Sir Garnet proceeds to point out, to have the power of supplementing it; and the utility of flags is warmly dwelt upon by him. But neither are they perfect. Flags are limited in range, slow and laborious in manipulation, they can be used only in specially selected positions, they are exposed to the observation of foes as well as friends, and in large operations are confusing from their number; they also require special atmospheric conditions and the absence of intervening obstacles. Indeed, free range, one of the two requirements of the heliograph, is obviously essential to every form of visual signalling; and if the second, viz., favourable atmospheric conditions, be not also existent, flags and similar devices are of but little use. Thus in rain, snow, and fog they are on a par with the heliograph, and in dull English weather, it is questionable if much advantage attends them, owing to the limited range attainable. The objections to the heliograph apply more or less, therefore, to every form of visual signalling; but it is scarcely fair to urge that, because it is not adapted to the English climate, it is not suited to English wants. The training and equipment of the Army is not directed exclusively against invasion. It is a long time since a foreign foe set foot on our shores, and it will probably be a long time ere one does again. Our fighting has been done chiefly where there is no lack of sunshine, in India, China, Africa, and similar climes, in which the objections to the heliograph lose all their force.

Allowing, therefore, that practice with the instrument may be attended with difficulty at home, no such difficulty exists where the Army is likely to be actively employed, and where about half of it is permanently stationed. It cannot be presumed that the training of the forces abroad is not as important as of those at home.

It has already been observed that, in combination with infinite disadvantages, the heliograph is, when compared with it in one or two respects, superior to the electric telegraph. In comparison with flags, it excels in range, speed, ease of manipulation, secrecy, less liability to confusion, and the capability of making itself seen. This last quality is, I think, deserving of special consideration. I understand that if flag-signallers are not placed with great care their motions cannot be discerned, while the flash from a heliograph at once commands attention. It is not necessary to choose for it a position against the sky line, or any particular kind of back ground, the signaller may be quite hidden, and not more than his general whereabouts known; his station may even be completely obscured by haze or mist, but the moment the flash of his instrument is truly directed it is strikingly visible. It is on this account not less than on its great range that it is believed to be so well adapted to assist in securing that "communication between "patrols reconnoitring and flanking parties," which is manifestly of such great importance. To further illustrate its possible use in field operations, if you will kindly pardon the evident want of strategy, and grant an eastern instead of an English climate, I will suppose an army lying in the neighbourhood of Sydenham, for the protection of London from an invader advancing from the south coast, and that reconnoitring parties have been sent to occupy at intervals the line of



hills from Sevenoaks to Epsom Downs. It is probable that not one of those parties would lose five minutes in making itself known, and establishing communication with head-quarters. And further, should the necessity arise for issuing new orders to the advanced parties, no longer time need be occupied in finding them out. The construction of the instrument is admirably suited to the accomplishment of such purpose. Pressing the tangent screw out of contact with the wheel, the mirror would be revolved slowly by the hand across the arc in which it was probable the out-party was. This being done twice or thrice at one elevation of the mirror, a turn of the vertical rod would admit of the process being repeated at another elevation, till by gradual changes every inch of ground had been searched and the outpost discovered. This power of establishing communication being admitted, I would submit whether the heliograph may not be found occasionally of much service to mounted reconnaissance parties. As conducted at present, if the party happens to fall into the hands of the enemy, the whole object of the expedition is lost. But if any member of it carried a heliograph, as intelligence was obtained it would be flashed back to head-quarters, and thus not only would valuable time be gained, but if any misfortune subsequently befel the party, the loss would be mitigated, as its purpose would have been served.

It will be observed that the only essential parts of the instrument, the mirror and adjustments, are removable; they weigh  $1\frac{1}{2}$  lbs., and by making the carbine or lance of a mounted man serve as a stand in the same way as the instrument has been fitted to a walking stick for the use of travellers, that would be the only additional weight imposed. But by folding the tripod legs, the instrument, ready mounted, may be carried in front of the saddle without inconvenience. It is made in any of these forms by Messrs. Elliott Brothers, Strand.

The official memorandum I have before alluded to, thus sums up the military value of the instrument as then discovered:—

“On the whole, it appears to me that while the heliograph will never supersede, or be substituted for flags, it may with great advantage supplement them; flags are so easily made, so portable, and so efficient for the ordinary signalling required at the outposts, &c., of an Army, that nothing better can probably be devised; but it is exactly where flags fail that the heliograph will be found useful. In India we cannot, I fear, expect to have telegraphic apparatus always at hand; and it is where a telegraph line would be so valuable that three or four heliographs might be worth their weight in gold, viz., to connect a force operating in the hills or elsewhere with the nearest electric telegraph station. For instance, during the Umbeyla campaign, a heliograph on the Crag Picquet, and another at Permulie, would have been found very useful; and in Abyssinia, where for want of wire the electric telegraph stopped at Antalo, a few heliographs would have extended the means of almost instantaneous communication up to the walls of Magdala. As it was, mounted orderlies had to be used to convey messages along this part of the line.”

The adaptation of sun-flashing to maritime affairs ought not to be

altogether overlooked. It might be employed from lighthouses and headlands along the coast in defensive operations, in coast-guard service, and for reporting the passing and arrival of vessels. Under favourable circumstances, too, I think it not impossible that directions could be flashed from the shore to boats and shipping at considerable distances, and if so, a wider scope would be given to it.

But to whatever extent the heliograph may be employed in military and naval operations, it is, I think, as a substitute for telegraphic communication in the ordinary affairs of life that it will be most appreciated. In many tropical countries where the laying and preservation of wires would be unremunerative, the heliograph is calculated to afford to the inhabitants most of the advantages of an electric telegraph, both as a means of internal communication, and to join them to distant commercial centres. It is not many years since the most civilised countries had to depend entirely on visual telegraphy. Many of my hearers will remember when semaphores were in universal use and esteem. The heliograph is infinitely superior to the semaphore, and, in tropical countries, its ability falls little short of an electric wire, inasmuch as besides being available throughout the day, by the application of artificial light, it can be used also at night, when both position and light being constant, one adjustment of the instrument is sufficient. With moonlight, also, it is very efficacious. In commercial cities to which telegraphs have not as yet been largely applied, it may be employed instead of the expensive underground and aerial wires. In countries where trunk lines only are laid, the heliograph will act as a feeder, bringing outlying parts into communication. It may further be employed in establishing communication along the frontiers and coasts of a country, and in an infinity of other ways to which I need not allude. Remembering that I am addressing a military audience, I have confined my remarks chiefly to the military uses of the instrument; and if I have succeeded in awakening attention to the subject of sun-flashing generally, and to the heliograph as a means of utilising it, I feel assured that it will be found a beneficent agent in emergencies yet unthought of.

MR. GREAVES: Some years ago I came across a volume of Galton's *Notes of Travel*, in which he describes how the North American Indians speedily availed themselves of this principle. They had found out the use of a mirror and from a lofty range of mountains, through gaps in the forest they had made use of a piece of glass to flash many miles across the country, a signal of their intentions and ideas, to another body of Indians in ambuscade at a distance. That was the most primitive use I have found of this principle. The Plain of Canterbury, in the middle island of New Zealand, extends some two millions of acres straight across to the mountains, and I have often noticed the position of a house on the mountains, simply by the rays of the evening sun striking on the panes of glass. I was at that time doing duty as a warden of the Trinity Board, and the idea suggested itself to me that the principle might be applied to our lighthouses. We have a lighthouse at the entrance of Port Lyttleton, in Canterbury, at an elevation of 480 feet, and the idea suggested itself to me, that the men in charge of the lighthouse by this method, might communicate with ships in the offing and pilot-boats by day or by night, by day with the light of the sun, by night with the artificial light; and in reading the Year Book of facts, I found that a flag staff that had been erected in Kew Gardens, of a great height, was finished with a glass diamond cut in facets, at

the top, and that from these facets the rays of the sun could be seen at great distances in the neighbouring counties. I think that the whole argument speaks for itself. It is the simplicity of nature, and it is so valuable that it is a wonder to me how it has remained in abeyance so long and has not been utilized.

Extract from a letter in the *Times*, of July 16th, 1855, from Charles Babbage the Philosopher, author of the Calculating Machine:—

"I have also evidence that the occulting system of lights was known at St. Petersburg in 1853, and I infer that it has been practically applied at Sebastopol, from the following extract from a letter of your correspondent at Balaklava, *Times*, July 11th.

"A long train of provisions came into Sebastopol to-day, and the mirror telegraph, which works by flashes from a mound over the Belbeck, was exceedingly busy all the forenoon."

"This can scarcely apply to any other than an occulting telegraph."

Extracted from *Good Words*, 1873, in an article on "Lighthouses of the Future," by Sir William Thomson, LL.D., F.R.S.

Lt.-Colonel WILKINSON, 16th Lancers: Will you allow me to say a word or two? The remarks that have been made at present this evening on this subject, have been in favour of this invention, and having used it myself for the last two years, I feel bound to say that there are some points to be raised against it. Nature is constantly cutting off your line of communication. A passing cloud is quite enough to interrupt the most important message; there is no means at hand to restore communication, and at the critical moment of a battle, your whole plans are disarranged by a cloud over the sun. This is an evil of such great magnitude, that it at once places sun-signalling in the second class. Besides this, even a shower of rain will interrupt it, and when we remember that in India (which is our best field for this very instrument) operations are usually, if possible, conducted in the cold weather, when it is not at all unusual to have cloudy skies, the instrument is frequently for days of no use. There is one thing in its favour which has not been urged this evening, namely, that it can be used at night with the full moon, which gives very clear and most pleasant signals visible without the use of any glasses, for a considerable number of miles; one argument in its favour, that of being seen at very great distances, is modified by the fact that there are few places where you can see a great distance. Instance, the valley of the Thames, where could you see any object three or four miles away, let alone forty? The difficulty is at once brought home to any one who practically attempts to use this instrument; and even in India the solar haze is so great and so dense in the middle of the day, that the flash is completely obscured at long distances, unless sent from very high ground. This "solar haze" is such a practical difficulty in the use of either the heliostat or the heliograph, that it becomes another reason why this instrument could not be universally trusted. The particular instrument before us, has, in my opinion, and in the opinion of many who have adopted this system of signalling, been far surpassed by an invention of Captain Begbie of the Madras Engineers. He and I, and others who have used the instrument as at present presented to you, have noticed that the action of the thumb on the lever, has a tendency to alter the position of the glass. You must remember your tripod is standing probably on sand or gravel, and the constant pressure of the thumb would cause the mirror to slightly move; thus creating the long and short flash, has a tendency to alter the position of the whole instrument. This is another fatal objection to the instrument as at present represented. Another is, that the staff on which you take your aim at the distant station, is so slender, that in practice it is difficult to detect the flash on it. Captain Begbie's system has a circular rim of metal with cross wires from it, and where the wires intersect each other in the centre of this circle there is a small hole, through which you accurately sight the distant station. This can be done with such extraordinary precision, that you can have no sort of doubt about the distant station seeing your flash, if you can see it clearly. He then places a screen on a separate tripod, immediately in front of the mirror. By a pressure of the thumb the screen is raised or depressed, and the screen rising in front of the mirror, completely obscures the flash, without in any way moving the tripod on which the mirror rests; therefore, you may be perfectly certain, if your mirror is adjusted,

that your distant station can see it, and that the pressure of your thumb has not altered the direction. Another great thing against this invention is, that the earth is constantly moving, and the readjustment is most vexatious; you have to be constantly readjusting the mirror as the earth revolves. Therefore, unless you are prepared, without the slightest danger of losing your position, to gradually correct the angle at which the sun-mirror is, you are certain soon to find your distant station giving the vexatious reply "repeat," which means that they have missed your signal. Another objection is, that if the sun is rising and you wish to signal to the west, you are quite unable to do so. Captain Begbie has met this by a most admirable plan, which, once used, is found to be invaluable. He has two mirrors; if the sun is rising, he places one to meet it, and throws the light from that one on to the signalling mirror, and by that he gets the full rays of the sun's surface. One other thing deserves attention with regard to this subject, and that is, artificial light; that, I believe to be the coming agent to supersede telegraphs and everything else for short distances.<sup>1</sup> With a strong powerful lamp used, not exactly as this instrument is used, but simply put in a conspicuous position, screened in a way that the enemy cannot see it, laterally, or from below, you can then signal with the greatest ease, without any fear of detection and for the whole night, without a single readjustment. You place a lamp, we will say, on a table; you are in an upper storey and place your table so far back that you are sure the rays of light will not reach the ground near you, but they go straight forward to the distant station. You place a screen in front of the lamp, which is worked by your thumb. In that way you can sit through the whole night, or as long as your lamp is burning; it can be seen, probably, ten miles; a good, ordinary, powerful, Kerosene lamp can be seen for ten miles. I have signalled myself with a little 2½ lb. lantern for three miles with the greatest ease and without the use of glasses, with a powerful lamp I believe ten miles could easily be done, and that is really almost as much as is practically required. With lamps nothing can interrupt you, no clouds can come in the way. Very few nights in India are there any fogs, the fogs usually come on towards the morning, but at any rate, whether cloudy or clear, you can use a lamp. I have known times in India, when we have been for three weeks or a month without a single day in which it is worth while to send out parties five or six miles, for the purpose of trying the heliostat, because we are almost sure we should be interrupted by clouds, and that is a very great drawback. By the use of the lamp at night, a party having been engaged as an outpost party all day (from an Army advancing in the field) and having individually collected important information, can assemble together, and from the highest available point, can pass back to head-quarters the information so collected. This may be done by a lamp, the best lamp in the village; they need not always carry one with them, but the best lamp in the village put on a common table with a screen in front of it, will ensure their signalling back ten miles with the greatest ease and with no fear of interruption. A single cloud over the sun will interrupt communication by means of the heliograph, and the worst of it is, if it is too much relied on, you are not prepared with anything to take its place: therefore, the interests of the Army may suffer seriously in the field.

MR. GOODE: I am very glad to have found so able a coadjutor in the gentleman who has just sat down, inasmuch as many of the points to which he has referred will be found in the paper, but I omitted them in reading, on account of the lateness of the hour.<sup>2</sup> With regard to Captain Begbie's modification of

<sup>1</sup> I believe that the electric telegraph is the only safe way of signalling a long distance, and is essential to the safety of an Army in the field.

<sup>2</sup> Another paper had been read earlier in the evening, the discussion of which occupied more than the allotted time, I therefore asked and obtained permission of the Chairman to omit certain portions of my paper which, if they had been read, would have anticipated many of Colonel Wilkinson's criticisms.

I may now be permitted to remark, that however liable to interruption heliograph signalling may be, the fact of communication being made possible at all, where the electric telegraph and all other signalling means have failed, is a fact of great

Mr. Mance's instrument (I think I am right in so describing it, and in claiming for Mr. Mance the credit of being the originator of the first practical means of talking by sun flashing), I may say, that Mr. Mance being in India when this idea was first worked out by him, he unreservedly put the apparatus into the possession of the Government of India, by whom it was tried under various phases and circumstances. As a matter of course, it got into the hands of the different signalling officers, and I presume of Captain Begbie amongst the number, who would naturally examine all the details of its construction, and doubtlessly endeavour to improve them. The instrument is not expected to be absolutely perfect, and it is quite possible that Captain Begbie's modifications may be of advantage. Mr. Mance's idea has been to keep the apparatus as simple as possible, and to confine it under ordinary circumstances to one instrument. This instrument weighs 5 lbs. with cases complete, and it can be made as light as 4 lbs. Captain Begbie's weighs 12 lbs., and being in two distinct parts, requires two operators. As regards the adaptation of artificial light to the heliograph, there is no doubt that the utility of the instrument can be vastly increased by that means, but the time at my disposal would scarcely admit of my entering into it fully, involving, as it does, the relative power of different lights, and many details as to the best means of preserving the signals from undesired observation. I have, however, mentioned that Captain Drummond's lamp was used for 66 miles in Ireland. For my own part I find a magnesium light, or a simple lime light, most convenient and serviceable, but an electric light at permanent stations might be more effective. The form of instrument to which I have chiefly directed your attention, is intended for use in the field, where the application of artificial light is not easy of accomplishment; with the other instrument here before you, which is constructed for permanent and semi-permanent positions, nothing could be simpler. With regard to the defects of sun-flashing, they are entered into to some extent in this paper. The heliograph is not put forward as an altogether independent means of signalling, but as an auxiliary. If the troops were operating in a country, where, owing to the formation of the ground, or want of sun, it was not available, they would simply fall back upon whatever signalling means they have at present. The instrument is made so light, portable, and inexpensive, that even if opportunity did not occur for its use, but little labour would have been wasted, while if its extraordinary power should be called into requisition, the results would fully compensate the trouble of carrying it.

With respect to the solar haze, the Indian reports speak specially as to the

importance, although the capability may not be constant. Colonel Wilkinson's remarks bear almost exclusively on the use of the instrument in the field. The signalling authorities at home and in India concur, however, in the opinion that the chief value of the heliograph will be at permanent stations. When so used, a basis other than "sand or gravel" will of course be made for it, and the line of direction between the stations being once accurately ascertained and marked, would always remain the same, the instruments being fixed. Supposing, then, Mance's Heliograph to be when in the field defective in the points named, which in the face of the official reports and continued trials I cannot admit, in permanent positions these defects could not possibly exist.

As to the necessity of adjusting the mirror to the constantly changing position of the sun, that process is as incumbent on Captain Begbie as on Mr. Mance; if he did not observe it his apparatus would be of but little worth.

Colonel Wilkinson forgets to mention that the working of a screen through 90° to cut off the flash is a much slower process than altering the inclination of a mirror, say 2°, and also that two men are essential to the working of Captain Begbie's method, while one only is required by Mance's. The working expenses of the former at fixed stations are thus doubled, and the rate of transmission is much slower.

It has been fully acknowledged by the Government of India that Mr. Mance is the originator of the means by which talking by sun-flashing is accomplished, and if the little defects mentioned have been discovered in his apparatus they admit of a very simple remedy. Instead of applying it, advantage has been taken to associate another name with the system, and so to transfer from Mr. Mance the credit which I think all must admit to be due to the inventor of the heliograph.—S. G.

capability of the flashes to pierce any ordinary haze, up to 15 miles, in which respect it much excels any other visual signalling apparatus.

The difficulty of flashing due north, when the sun is due south, is apparent only. Mr. Mance in his *original* instructions, dated 1871, makes special mention of the use of a second mirror under such circumstances, which instrument would also serve as a reserve in case of accident.

It has been said there is some difficulty in getting the adjustment perfect, owing to the apparent movement of the sun. I can only say, that I find in the memorandum from the Quarter-Master General's Department, this testimony, "All the reports agree in the following points (a), that the signals given by the heliograph are perfectly clear and satisfactory, and (b), that they can easily be read in ordinary weather without telescopes up to 50 miles." And it is singular that the official reports should have been so unanimous in pronouncing the signals "clear and satisfactory," if they could not be directed truly, as in that case they would not be seen. It is quite possible that with instruments made in India without Mr. Mance's supervision, and with manipulators not very experienced in their use, some such difficulty might arise. But if the alignment is once correctly made, the signaller has only to see that the flash rises to the stud, and if so it must be visible. A slight movement of the adjusting screws obviates the movement of the sun, and this can be done without interruption to the signalling. I cannot assert that Captain Begbie's modification is attended with no advantages over Mr. Mance's method, but it is evident there are disadvantages too. I think you will see that it is simply a modification of it, and that to Mr. Mance is due the credit of having first utilized sun-flashing as a speaking means.

The CHAIRMAN: We must feel very much indebted to Mr. Goode for bringing this subject before us. The subject is certainly very interesting. As to the originating the plan of talking by reflections, I think we have had one instance of its being very old. I happen to know another, the case of Admiral Sheriff, then Captain of the Port of Gibraltar; and in 1835, he told me he used, with a common looking glass, to talk to his friends at Tangier continually. But these are all tentative things; after all the credit is due, not so much for digging the rude ore of any invention, but for perfecting it and bringing it to use practically for the nation. Though this instrument may not be perfect for close use in the field, I quite see that for distant use under certain circumstances, it may be of the very greatest importance, not perhaps as fulfilling all the communications requisite, between armies and distant stations, but as fulfilling a great many requirements of very great utility. At any rate, I think we are all very much obliged to Mr. Goode for having brought this before us.

## APPENDIX.

### THE MORSE CODE.

Having found the following table of great assistance in acquiring the Morse Code myself, and as I have known others master it by this means in a few hours, learners, who have no special arrangement of their own, may be pleased to avail themselves of it.

1. The signs or characters employed are two, — the dot, and — the dash.
2. The combination of these signs to represent the letters of the alphabet are arranged in two columns; all those commencing with the dot being placed in one, and those commencing with the dash in the other. No letter involves more than four signs.
3. In the dot column, the dot is regarded as the key-note. Recourse is not had to two key-notes until the various forms of one have been exhausted. Every succeeding combination is thus a wider departure from the simplest form than the one preceding it, and its position in the code is thus indicated.
4. The combinations are divided into three groups. In group 1 are placed all those in which *one* character only is employed; in group 2 the *second* character is added; in group 3 the *two* characters are *intermingled*. On the dot side of group 1



are the combinations, one dot, two dots, three dots, four dots, representing e, i, s, h, or the two-syllabled word e-ish; the corresponding combinations on the dash side indicate t, m, o, not *t-o-m*, and ch, which is an extra.

In group 2 the order of the combinations is equally natural, one dot and one dash, one dot and two dashes, and one dot and three dashes, representing a, w, j; the corresponding combinations on the dash side are for u, d, b. The same group includes,—though somewhat removed, as having more than one key-note, u and v, represented by two dots and one dash, and three dots and one dash. On the other side two dashes and one dot are the symbols for g.

The combinations in group 3 in which the characters are *intermingled* all involve four signs; they represent l, p, f, on the dot side, and y, c, x, q, z, on the dash side, the order of which may be remembered by the phrase, "why see excused."

It will be seen that these follow the same rule as the previous groups; first, there is one dot and one dash (the number of signs in this and the remaining combinations of the group being made up to four by adding the sign of the column); then one dot and two dashes; then two dots and one dash, where the series stops. On the other side the order is one dash and one dot; then one dash and one dot with a different termination; then one dash and two dots, two dashes and one dot, and two dashes and two dots.

The two combinations at the foot r, and the counterpart k, are so placed because they involve *three intermingled* signs only.

## Group 1.

e —  
i — —  
s — — —  
h — — — —

t —  
m — — —  
o — — — —  
ch — — — — —

## Group 2.

a — — —  
w — — — —  
j — — — — —  
  
u — — — —  
v — — — — —

n — — —  
d — — — —  
b — — — — —  
  
g — — — — —

## Group 3.

l — — — —  
p — — — — —  
f — — — — —  
  
r — — — —

y — — — — —  
c — — — — —  
x — — — — —  
q — — — — —  
z — — — — —  
  
k — — — — —

The table is of greater service to a reader than to a sender, forming as it does a mental pictorial dictionary, to which any signal can be at once referred for interpretation. The first sign observed determines the column in which the combination is to be found; the right group is discovered in most cases ere the combination is completed, while its exact position in the group cannot be mistaken if the principle on which the table is arranged be once understood.

5, Gray's-inn Square, W.C.

S. GOODE.



## SPECIAL LECTURE.

Friday, June 18th, 1875.

GENERAL SIR WILLIAM J. CODRINGTON, G.C.B., Vice-President,  
in the Chair.

### THE ARMED STRENGTH OF EUROPE.

By C. E. HOWARD VINCENT, Esq., F.R.G.S., late 23rd Royal Welsh  
Fusiliers.

Two years, Sir William Codrington, have gone by since you were last pleased to encourage me by taking that chair. On the morrow of the day that I was afforded the privilege of occupying this place, I enlisted in the ranks of the law. The act was not unaccompanied by regret on my part, but chiefly on account of the severance which I feared to my connection with this Institution. The Fates, however, have been kind, and the Council yet kinder. At their request do I stand here to-day to address you, gentlemen, on the subject of "The Armed Strength of Europe."

The subject is, I fear, a dry one. It embraces many dull statistics. Nor in many of its particulars does it afford much scope for novel treatment. Yet its importance in the present era of "wars and rumours of wars" is very considerable. To the task, unless, supported by your kind indulgence, do I feel myself wholly unequal. Other claims also have I on your lenient consideration—the necessity for passing the now obligatory legal examinations, a press of occupation, and last, but not least, the mass of conflicting data<sup>1</sup> with which I have had to deal.

<sup>1</sup> Works consulted *inter alia* :—

- |  |   |  |
|--|---|--|
| "Armed Strength of Russia."  | } | Published by the Intelligence<br>Department, War Office. |
| " " " Austria."  |   |  |
| " " " Denmark."  |   |  |
| " " " Sweden and Norway."  |   |  |
| "Vergleichende Darstellung der Wehrver-<br>hältnisse in Europa zur Land und zur<br>See." | } | Published by the Austrian<br>War Office.                 |
| "Bulletins de la Reunion des Officiers."   |   |  |
| "Revue Maritimes et Coloniales."   |   |  |
| "Almanach de Gotha, 1875."   |   |  |
| "Russia's Advance Eastward." (King and Co.)  |   |  |
| "Statesman's Year Book, 1875."   |   |  |
| "Vienni Sborniki."   |   |  |
| "Rivista Militare."  |   |  |
| "Jahrbücher für die Deutsche Armée und Marine."  |   |  |
| "Treaties of Guarantee." (Presented to Parliament.)                                      |   |  |

No doubt you have been struck by the peculiar fitness of the day for such a subject. At this very hour sixty years ago the fate of Europe was at stake. The field of Waterloo, now a peaceful plain, now the subject of a beautiful model within these walls, was strewn with the dead and dying. Backwards and forwards rolled the tide of battle; but ere sunset, British valour, timely succoured by Prussian bayonets, overthrew the foe to peace.

“ This England never did, nor never shall,  
Lie at the proud foot of a conqueror.”

I must not detain you with the memories of a glorious past. I will hurry on to my subject. But how shall I treat it? Herein lies no small difficulty. Some have said, “take the major States separately, and group the minor;” some that I should consider Europe collectively. I shall, however, make bold to conduct you personally, as it were, round Europe. I shall pursue this course because I cannot help thinking that although a dwarf’s cabin may lie at the castle gate of the giant, his action in certain contingencies may be of material importance to the great man. Again, the armed strength of nations is only of practical moment when relatively considered between possible foes, and neighbours must, *ex necessitate rei*, always be possible foes. Save as a matter of statistical interest, the aggregate contribution of European countries to purposes of war can only affect in a very remote degree the welfare of any individual State.

I have one other difficulty to lay before you—the express request that I should give due prominence to naval matters, but I regret to say that my knowledge of navies, of ships, is very limited.

Finally, I will remind you that, by the rules of this Institution, lecturers alone are responsible for what they utter in this theatre, therefore all my conclusions are purely personal, and in no way ratified by the Council or by any official.

#### *Holland.*

The route to Rotterdam is that offering the majority of advantages in commencing this continental tour. It lands us at once in a country whose welfare is of the utmost moment to ourselves. The supposed eyesore of a mighty neighbour—the independence of the Netherlands—is a matter of international concern. To preserve it, the House of Orange has an army supplied partly by voluntary enlistment, partly by conscription. Five years is the nominal period of service; but after one year, the recruits are allowed to return home, subject only to an annual training of six weeks, for the remaining four years. There may be some present who herein will recognise an idea that has been of late put forward for the instruction of our Militia.

In Reserves Holland is rich, or, rather, in poorly-trained adjuncts to the regular forces—a more than questionable support in the hour of danger. The Militia is divided into two classes, the first numbering some 40,000, comprising all men from the 25th to the 34th year of their age, and divided into groups, one containing the bachelors and

widowers without children, and the other married men and widowers with children. In addition to this active Militia, there is the "resting Militia," numbering some 71,000 men.

The military forces which Holland can assemble for the defence of the country consist, then, of—

- 68 battalions of infantry, of 5 companies,
- 111 companies of technical troops.
- 24 squadrons of cavalry, 4 to a regiment,
- 18 batteries of artillery of six guns,  
with a "combatant" strength of
- 90,260 infantry, armed with the Snider and Beaumont breech-loaders,
- 3,850 cavalry,
- 108 bronze breech-loading rifled guns.

The Dutch navy consists of 113 ships (of which 17 are armour-plated), with 981 guns, and 7,250 men.

The navy is exclusively recruited by enlistment; for although conscription is allowable, it is never enforced.

Such are the artificial safeguards of Holland: and theoretically they are more than supported by the power of inundation. I take this latter, however, to be a remedy which would never be resorted to, for it must inevitably bring far greater suffering on the attacked than on the attackers. It is possible that an attempt at inundation might be made in an extreme case, the invaders giving timely notice of their approach, so as to enable the Dutch to remove themselves, their homes, and their goods to secure havens; but I feel convinced that any rapid invading movement would materially bring out the philosophy of the Dutch character. We must take steps to frustrate the ingress of the thief, not content ourselves with the reflection that if he does effect an entrance we shall set fire to our house. "Forewarned is forearmed." It is useless for threatened States to stem the tide, the bitter stream, of universal service. The Dutch must sacrifice some comfort that they may be shielded against the coming storm.

#### *Belgium.*

We next come to Belgium—to a land dearly allied to us by dynastic ties, by uniformity of interest and by solemn treaty. Here, too, we find a country threatened, continually threatened, not by one gigantic neighbour, but by two. In the same degree that Germany looks paternally over Holland from the community of language, does France look with maternal affection over Belgium. How often even within my own time has the safety of Belgium been, or imagined to have been, endangered? Nevertheless, here, as in the sister country, do we find an army formed by conscription, with substitutes. The period of service is eight years, two-thirds of which are usually spent on furlough. In addition to this active Army there is a *Garde Nationale*, comprising every Belgian capable of bearing arms, but neither fitted nor intended for service in the field. Numerically the *National Guard*

is strong enough, 125,000, without the reserve, or 400,000 with it. In Belgium, then, we find—

84 battalions (mostly of 4 companies) of infantry, armed with

Albini, Braendlin, and Comblain breechloaders;

16 companies of engineers;

45 squadrons (4 to a regiment) of cavalry;

20 batteries (of six guns) of artillery;

with a "combatant" total of 130,000 infantry, 7,500 cavalry, and 152 guns, on the Prussian system.

Since October, 1874, the kingdom has been divided into two military conscriptions, the one embracing the provinces of Antwerp and of East and West Flanders, the other Brabant, Hainaut, Liège, Limbourg, Luxembourg, and Namur.

Do you tell me that I ignore the first requisites of national prosperity when I say that compulsory and universal service is necessary for two thriving and industrial peoples? I am sensible of the reproach. I am sensible of the misery that such an innovation must necessarily entail. I am aware of its results in a neighbouring country. But the very existence of Holland and of Belgium as independent States hangs on their being able at any minute to act up to that sovereign rule of war, "to bring masses to bear on fractions of the enemy." No "silver streak" has to be crossed by an invader. No time will be given for preparation, for mobilisation. Six hours after the declaration of war, hostile troops will be within the frontier, and, as the *Fortnightly Reviewist* aptly remarks, "The Belgian Army" is not fit—and no one knows this better than the Belgian Ministry—"to be put into line of battle."

The reflection is melancholy for ourselves, for our ally, and for the peace of Europe, as Great Britain, conjointly with France, Prussia, Russia, and the Netherlands, is bound by treaty, concluded in 1839, to preserve the independence and neutrality of Belgium, and by treaties with Germany and with France in 1870, to co-operate for that purpose with her naval and military forces against the invader. I have little doubt that our assistance skilfully rendered would effect the desired end, yet it is not too much to require of Belgium that she should be prepared to help herself.

#### *Sweden and Norway.*

But let us turn to a brighter picture. Let us follow that brilliant example of British enterprise, the Arctic Expedition, on its northern course. Yet not into the frigid zone that is to witness its labours. We will alight rather in that happiest of kingdoms, Sweden and Norway. Safe from invasion, devoid of ambition, thrifty, contented, and industrious, at peace within, at peace without, free from sorrow in the present, secured from danger in the future, Oscar II sways a sceptre worthy of his race.

The organisation of the Army is peculiar, nor does it appear to me based upon any sound and modern principle. Four times did the late King submit measures to the representatives of the people, for the

reorganisation of the defences of the country, and four times did the deputies elect to pursue the even tenor of their way.

In Sweden we find four distinct classes of troops—

(1.) The "Värfvade" or enlisted troops, including two regiments of cavalry, the artillery, and the engineers, the whole numbering 6,718 Officers, Non-commissioned Officers, and men.

(2.) The "Indelta" or national Militia, maintained by the landowners and out of the proceeds of certain state domains. For this expenditure the landlord is exempted from further contribution to the peace establishment. Service in the Indelta is determined by the ordinary law of master and servant. The landowner makes a bargain with his servant, secures to him certain payments and advantages, and the contract is upheld by the State. The length of service extends over thirty years. In time of peace the infantry are called up for one month's annual training and the cavalry for 42 days.

(3.) The third class consists of the Militia of Gothland.

(4.) The fourth of the "Bevåring" or troops levied by conscription without substitutes, between 20 and 25 years of age. The "Bevåring" is divided into five classes, the two youngest of which alone are liable to be called out for yearly exercise, and that for only 15 days. It is supposed that the "Bevåring" might produce some 92,000 in all, but the calculation is far from easy.

I cannot hope, in the limited time at my command, to convey to you any accurate idea of the complicated military system of Sweden.

In Norway we find a far more tangible machinery. The Army is supplied partly by conscription, partly by enlistment, and is supplemented by the Landvaern or Militia—liable only to serve within the kingdom—and then again we have the Landstorm.

In all, the military forces at the joint disposal of Sweden and Norway, may be said to amount in time of war to—

122 battalions, mostly armed with the Remington,  
15 companies of engineers,  
58 squadrons of cavalry,  
40 batteries of artillery,

with 152,800 infantry, 10,540 cavalry, and 322 guns, plus 20,000 Volunteers.

The Navies of Sweden and Norway are both recruited partly by voluntary enlistment, partly by conscription among the seafaring population.

United they consist of 65 vessels, of which 5 are armour-plated, with 491 guns, and 5,100 men.

Sweden and Norway, by Treaty concluded in 1855, we are also bound jointly with France to protect against any Russian attack that may be directed against them. The advantage—the maritime advantage—of the kingdom to Russia, is undoubtedly great; but although at one time the eyes of the St. Petersburg Cabinet were directed in that quarter, we may rest assured that there is no danger at present of our being called upon to fulfil our obligations; and even should such arise, despite the probable attitude of France, we need have little fear for the result.

*Denmark.*

Denmark is the next country which invites our attention. A Princess of its Royal House, now on the steps of the British Throne, commands for her country the unbounded affection of Englishmen. Valiantly as strove the Danes through the bitter winter of 1864, "God favoured the big battalions," and the reckoning for Denmark has yet to come.

Her troops are of the best quality, of the best *physique*, yet perfect organisation still is wanting. A new scheme has recently been presented to the Danish Parliament, and will no doubt be adopted in its principal provisions. Several years must nevertheless elapse ere it can be regarded as an accomplished fact.

Denmark is wiser in its generation than the three minor powers we have just considered. In 1867, compulsory service was established for all able-bodied males between the ages of 22 and 38 years—16 years in all, whereof 8 are passed in the regular Army, and 8 in the Reserve. Of the first portion the men are under arms but a limited time; they are then released on furlough.

The combatant strength of the Danish Army may be set down, as far as I am able to gather, at—

5 Territorial brigades,  
42 battalions of infantry, armed with the Snider and Remington rifles,  
28 companies of engineers,  
21 squadrons of cavalry,  
12 batteries of artillery,  
with 36,050 foot, 2,100 horse, and 96 guns.

In given contingencies, the action of the Danish fleet may be of the utmost importance to Great Britain. It is small numerically, but acting in a confined area, wherein possession is more than nine points of the law, its efficient condition is a matter of no ordinary moment.

The navy of Denmark is recruited by conscription from the seafaring population. It comprises 31 steamers, whereof 6 are ironclad. Three have been converted on the French model. The strongest vessel is the "Odin," of Danish build, a turret 8-inch armour-plated screw vessel, fitted with a peculiar steel ram, 6 feet in length, and hidden, when not required, in the hull. The "Odin" carries four 10-inch 19 ton guns.

I cannot dismiss Denmark from your consideration without calling to notice the very important project for defence embodied in the novel scheme. It includes—

- (1.) The establishment of works on the Little Belt.
- (2.) Establishment of works on the Great Belt.
- (3.) Establishment of a coast battery at Kronborg.
- (4.) Strengthening of the sea works at Copenhagen.
- (5.) Strengthening of the land works at Copenhagen.
- (6.) Augmentation of the Fleet.
- (7.) Establishment of a *point d'appui* for the Fleet on the Great Belt.

Look at the map behind me, and observe for yourselves what will be the possible effect of these plans. Look at the narrow passage any westward bound fleet has to pass through, and tell me if I over-estimate the importance of the Danish hold of the Belts and the Sound. As we hold the door to the Mediterranean, so in a measure does Denmark hold the passage of the Baltic. In four years the defences of the Great and Little Belt will be completed; in seven, those of Copenhagen. Let England hold out the hand of friendship. Let us secure an ally, and let the amity of Governments and the love of peoples cement the ties of Royal blood.

*Germany.*

To the old Prussia, now developed into the modern Germany, does Europe owe the startling military reforms of recent years. How different 61 years ago was the official tone of Berlin. Ministers came and went down to their bureaux oppressed by the falling fortunes of the State. The gardens were deserted. How to resist Cæsar was the waking and the sleeping thought of all grades.

But from out that Slough of Despond there came two masters. A mine is laid. The issue of this anniversary encourages the sinking of the shaft. Gallery after gallery is run out; flaws are remedied. Fifty-two years of practically uninterrupted quiet favour the perfecting of the fabric, and then as with a spring the roof is removed. The country's rival bites the dust, and Europe stands mute with mingled fear and admiration.

You cannot wish me to enter into any detailed consideration of the marvellous process by which Teuton masses bear down upon their enemy. More than once has this theatre been a witness of the admiration in which you hold it. For years the public journals have teemed with descriptions, with panegyric now of this branch, now of that. I will therefore content myself with observing that the German Army numbers in time of peace—

18,079 Officers,  
401,659 men,  
97,379 horses,

which are in time of war increased to—

31,195 Officers,  
1,273,346 men,  
270,920 horses, and  
2,472 field guns.

In addition to these gigantic totals, the new Landsturm Bill provides an organised force for the defence of German hearths and homes. The Landsturm is to be divided into two classes. The first, including all able-bodied men not already in the army, distributed into 293 battalions, and calculated to produce 175,800 men.

This addition will bring the German war strength to over 1,700,000 men!

The second base of the Landsturm will include every other available male, but will not for the present be organised.



One million and three-quarters of men available! One million of combatants, whereof half can be brought to-morrow to bear on any one spot!

But think not that this result is achieved without effort. Consider that it demands the greatest sacrifices from every class of society. The nobility tread for life in the unremunerative profession of arms. An axe is held over every united family, every domestic circle. The "emigration returns" show how great is the burden. A veritable exodus has taken place since the war, and I am informed (though with what truth I cannot say), that a treaty on this head is in negotiation between Germany and the country where these tens of thousands of fugitives from the yoke of military service find a ready shelter and the road to wealth.

The German Navy is yet in its childhood. But a very short time ago it was in its infancy. Now it is rapidly growing into manhood. In 1848 only was the foundation laid. For the last few years no efforts have been spared to hasten its development.

The two largest ships are the ironclads "Kaiser" and "Deutschland," both built by Messrs. Samuda Brothers at Poplar, after the designs of Mr. E. J. Reed, C.B., and both armed with eight 22-ton steel breech-loading guns, arranged to fire broadside. The two foremost guns, one on each side, are also adapted for use as bow-chasers, and are capable of being trained to cross-fire before the ship. The two after guns can be trained to fire within  $15^{\circ}$  of the line of keel. In addition to these eight guns there is an 18-ton gun placed aft capable of being trained to an angle of  $15^{\circ}$  each side the middle line, thus making, with the central battery guns, a complete all-round fire.

The four next ironclads of Germany are the turret ships "Grosser Kurfürst," "Friedrich der Grosse," and "Preussen," all the production in 1873 and 1874 of German dockyards.

The navy is manned by some 9,000 Officers and men; the latter drawn by conscription from the seafaring population, estimated at 80,000, who on that account are exempted from military service.

Great inducements are further held out to able-bodied seamen to volunteer for the navy, and not a few are thus obtained.

Germany has three ports of war, at Kiel and Danzig, on the Baltic, and at Wilhelmshaven, on the North Sea. The latter is the most important, and is intended for the nursery of the German Navy of the future.

The port of Wilhelmshaven is an immense artificial construction of granite, comprising five separate harbours, with canals, sluices to regulate the tide, and an array of dry docks for ordinary and ironclad vessels. The first harbour is an artificial basin 700 feet long and 350 wide, leading to the first sluice, 132 feet long and 66 wide. The next basin or outer harbour is 600 feet long and 400 wide, with a similar sluice behind. Then comes a canal 3,600 feet long, varying in width from 260 to 108 feet, and having about half-way another harbour for dredging steamers and similar craft. This leads to the principal basin, 1,200 feet long and 750 wide, having a small adjacent basin for boats. At the back of the principal harbour are two large shipyards.

Such is the state of the German Navy, and such the means of development that it actually possesses. Its ships are fine, its Officers well trained and bold, its men hardy as our own, but its growth must be limited until such time as its range is extended on the North Sea. Such time will come, must come, be it soon, be it late, and then must England look to her laurels.

### *Russia.*

Eastwards will we now direct our steps—to that country whose every movement is eagerly watched by ourselves, by all Europe. Often before has the attitude of the Russian Court been the cause of much anxiety, but never was Russian influence more paramount in the counsels of European Cabinets. Sixty years ago such was the position of England, but "*tempora mutantur.*"

We will cross the Vistula at Warsaw. Two bridges will shortly carry the passenger over the stream. The one a railway bridge, either end protected by a fortification, which, in the event of invasion, will entirely supplant its stately fellow. We will not tarry in Poland. We will plunge at once into the heart of the empire.

"The Russian Army"<sup>1</sup> formed the subject of a lecture of mine in this theatre three years ago. Some of you may probably have read it. I need not therefore trouble you with any detailed account of Russian military organisation. I will simply say that the universal service on which it is now based produces a total war strength of

752,095 combatant infantry,  
172,743 cavalry,  
with  
2,768 guns, including  
400 mitrailleuses.

In ten or fifteen years, the land forces of the empire will number two million men, of which about three-fourths will be combatant.

Owing, however, to the vast area of Russian territory, the difficulties of communication, and the conditions of climate, this gigantic total is much less alarming than it at first sight appears.

The Russian Navy is increasing every day in importance, but owing to more than one geographical consideration, its sphere of action is at present very limited. Numerically the Russian Navy consists of some 300 vessels, including 25 ironclads, with an armament of over 1,500 guns. By far the most important part of the navy, and nearly all the ironclads, comprise the Baltic fleet. For eight months of the year it is doomed to a forced idleness, and at best has to pass treacherous channels ere the wide ocean places it on an equality with its rivals.

The other great division of the fleet is stationed in the Black Sea. It numbers some 35 or 40 vessels of light draught, carrying about 90 guns. To them a new circular ironclad of unusual power has recently been added, and the dockyard at Nicolaïeff has plenty of work on hand. Indeed this is no novelty, and the local authorities

<sup>1</sup> See Journal, vol. xvi, page 285, *et seq.*

were but little taken aback by the act which restored the Black Sea to the Russian flag of war. It is highly improbable, however, that the Government of the Tsar contemplate making any great additions at present to the Black Sea division, nor to form an ironclad fleet in those waters, and this for reasons that must be patent to every one.

The first vessel of the Russian ironclad navy, unless it be the new "Novgorod Popoffka," is the mastless turret-ship "Peter the Great," launched at Kronstadt in 1874. The "Peter the Great" resembles in design and construction the great mastless turret-ships of the British Navy, and more especially the "Devastation." The "Peter the Great" carries, like the "Devastation" and her sister ships the "Thunderer" and the "Fury," two turrets, with an armament of four 35-ton guns, the latter made of Krupp steel. After the "Peter the Great" rank the "Sevastopol," nearly on a par with the "Black Prince" and "Warrior," and then the "Kniaz Pojarski."

#### *Turkey.*

We have now arrived at the centre of the Anglo-Russian future—Constantinople. From here, and not from Asiatic steppes, radiate the troubles to come. Much could I say on this head, but this is neither the time nor the place. Suffer me though to entreat you not to be misled by movements and counter-movements far from the true arena of action. Search the fruitful plain below instead of straining your eyesight by peering into a desert horizon.

Since 1871 the Turkish Army has been completely re-organised, but whether co-equally in theory and in practice it is not for me, with such feeble resources as are at my command, to opine. Official statements set down the military forces of the Sultan last year as consisting of—

170,376 regulars,  
148,680 reserves,  
75,000 auxiliaries,  
87,000 irregulars;

Presenting a grand total of—

353,551 combatant infantry,  
21,275 cavalry,  
with 648 guns.

The Turkish ironclad Navy is, I believe, one of the finest in the world, and is, as you doubtless know, commanded by an Englishman of no less ability than experience. Twenty splendid ships lie "at anchor," says a diplomatic report, "all the year round in idle state in sight of the Imperial Palace." Such a force, put to so little use, may well be looked on wistfully from other quarters.

You well know that, conjointly with Austria and France, we are bound to preserve the independence of the Ottoman Empire, and that independence, whether with but one ally, or alone, we shall, we must, and we can maintain.

I will not add more as to the condition of things in Turkey, espe-

cially as I hope to go this year and see what cannot be ascertained from books.

*Greece.*

We need not tarry long with the 100,000 Greeks and 50 guns, with the 20 ships and 2 ironclads that the Government of Athens is reputed to have at command; we will therefore, hurry northwards to

*Austria—Hungary.*

The Austrian army has likewise afforded me a previous theme in this theatre.<sup>1</sup> Immense have been the efforts of recent years to reduce to a minimum the possibility of such ill fortune attending the valour and the nobility, of the Hapsburg arms in the future as has beset them in the past.

798,172 infantry,  
62,746 cavalry,  
and 1,616 guns,

can Austria, our historical, our natural ally, now put into the field; and rapidly recovering from the disasters of a double war, guided by prudent statesmen, bordered by two puissant States, both courting her alliance, both dreading her enmity, the Viennese Government is every day producing a more direct influence on European affairs.

The Navy has not been thrown into the shade by the efforts that have been directed towards the Army. Eight or ten ironclads now form the fleet of Austria in the Adriatic. The most formidable vessel is the new "Custoza." The battle of Lissa fully demonstrated the utility of the ram, and this experience has been borne in mind in the construction of the "Custoza," though in such degree as to enable both the ram and the artillery of the ship to be employed simultaneously, a result unachieved, I understand, as a general rule.

Austria has two harbours of war—Pola and Trieste. The former has been recently enlarged, so as to be able to accommodate the entire fleet, and is strongly fortified both towards the sea and the land, while Trieste is the great arsenal of the Imperial Navy.

We will now pass to

*Italy.*

The Government of *Il re Galantuomo* has not been the most backward in responding to the call of the day in its military institutions. The German law of universal liability forms the basis of the present military organisation of the Kingdom of Italy. Some 70,000 young men are levied annually for the standing Army, while the rest are relegated to the Reserve, subject to an annual call for forty-two days' training.

By a recent enactment, the country was divided into sixteen territorial military districts, and according to official returns published last year, the combatant war strength of the Italian Army consisted of—

<sup>1</sup> See Journal, vol. xvii, page 527, *et seq.*

447,264 infantry, armed mostly with the Remington  
breech-loader,  
15,850 cavalry,  
and  
1,240 guns.

Great attention has been paid to the requirements of modern science as regards the Italian Navy, and large contracts have recently been, or are about to be entered into. But, as in February last, the Government determined to sell 32 ships, I am wholly unable to set before you the numerical strength of the Italian fleet.

The Italians are building an immense dockyard and arsenal at Spezzia, which will doubtless be the great depôt. Venice, however, affords a secure base of operations in the Adriatic.

#### *Spain.*

From Italy we may glance at Spain, but of the military forces of that country, you, Gentlemen, are as competent judges as all the official documents in the world. The state of affairs is more than deplorable, and we can but hope that Cabrera's untiring efforts towards peace may ere long terminate the troubles of his youthful Sovereign.

Time was when the Spanish Navy knew but one superior. It still contains some 7 or 8 ironclad vessels, all built in England, with an aggregate armament of 169 guns. There are also, says the Austrian War Office, 67 other vessels, but it is difficult to conceive that the Army has not deprived them of their due complement of men.

#### *Portugal.*

Amid all the disturbance around, Portugal treads calmly on. Its Army, like those of the minor Northern States, is formed partly by conscription, partly by voluntary enlistment. Eleven years ago a project of reorganisation was adopted, but financial causes have intervened to check its development. Yet it is probable that with time to organise, and an incentive to energy, the Portuguese could put some

50,000 combatants and  
100 guns

into the field.

The Navy of Portugal numbers about 50 ships, but not more than one-half are seaworthy. I am informed, however, on high authority, that 6 ironclads now building in England will shortly claim the Tagus as their home, to be joined, if the almost impossible necessity arise, by the fleets of Britain, in fulfilment of various treaties concluded between 1373 and 1815.

#### *Switzerland.*

Many of you, whilst delighting in the scenery, have probably made yourselves acquainted with the defensive system of Switzerland—that peculiar system, which a writer, more zealous than practical, thought well adapted for Great Britain.

You are aware that by the fundamental laws of the republic the maintenance of a standing Army is prohibited. The 18th article of the Constitution of last year enacts that "Every Swiss is liable to serve in the defence of his country." He may indeed serve, but how is he to get the training necessary to give effect to his service—by a fortnight's annual exercise?

The troops of the Republic are divided into three classes, viz. :—

(1.) The Bundes Auszug, consisting of all men able to bear arms from the age of 20 to 30.

(2.) The Reserve, consisting of all men who have served in the first class from 31 to 40.

(3.) The Militia, comprising all men from the 41st to the 44th year. The Officers themselves are not a permanent Institution.

The paper strength of this force is set down at 201,578 men, which is "estimated" to produce a combatant total of

174,000 infantry,  
5,000 cavalry, and  
294 guns.

Does history show that battles are won by patriotism alone? If so, the Swiss will overthrow any foe. If not, the pecuniary subsidies—men they cannot be—that England will have to furnish by the Treaty of Paris of 1815, will be thrown away.

#### *France.*

We are now nearing the end of our tour. France alone remains for consideration, that "nation of gallant men, of men of honour, and of "cavaliers." With a recuperative power peculiar to Gaul, Frenchmen have been unremittently devoting themselves to remedy the evils in their military administration which the last war laid bare in so terrible a manner. Those, however, who know France best, who have resided there of late, will need no telling how much there is yet to do, in what a transition state is the whole mechanism of the Army, how wholly unfit it is at present for revenge. The new laws are but imperfectly understood by the local officials, and years must elapse ere the eagles of France can again be borne against a foe. Not half a million combatants is it possible for France to put into the field, and ere even this, we may almost say paltry, number could be brought to bear on any one spot, could be available for the defence of one frontier, could be concentrated for any attack, months of preparation would be essential.

Gentlemen, these are facts—facts, it may be, but little palatable to the pride of Frenchmen, but, nevertheless, undeniable facts, which you will do well to bear in mind when reflecting upon recent events.

It may none the less be interesting to you to know the rough outline in the French project of Army reorganisation. It is well embodied in the first article of the third chapter of the "Loi sur le Recrutement." "Every Frenchman not declared unfit for military service must be "for 5 years in the active Army, for 4 years in the Reserve of the "active Army, for 5 years in the Territorial Army, and for 6 years in

"the Reserve of the Territorial Army." Neither the active Army nor its Reserve are in any way localised, but drawn from and distributed over the whole of France. On the other hand, the Territorial Army and its Reserve are confined to determinate districts.

A very marked improvement has taken place since the war, in the officering and training of the French Army. Greater attention is paid than before to technical study and professional duties, and, learning from the victor, no pains are spared to develop the efficiency of the soldier.

The Navy is now much sought after by the blue blood of France. In ships it is strong. Hard upon 350 ships of war hoist the tri-colour. Some 50 vessels form its ironclad fleet, and although I am informed that their efficiency is great, it is somewhat to be feared that the demands on the public purse with respect to the Army will preclude for the present any considerable expenditure on vessels of the most recent and formidable type.

The French Navy is manned partly by conscription and partly by voluntary enlistment. So early as 1683 was the marine conscription introduced. On the *Inscription Maritime* are the names of all males of the maritime population, numbering some 150,000. The length of service in the Navy is similar to that in the Army, and the law of 1872 provides that a certain number of young men liable to service in the active Army may select instead the naval service, if duly fitted thereto, even if not enrolled on the *Inscription Maritime*.

For administrative purposes France is divided into five maritime districts, viz. :—

- |                 |                 |
|-----------------|-----------------|
| (1.) Cherbourg, | (4.) Rochefort, |
| (2.) Brest,     | (5.) Toulon,    |
| (3.) Lorient,   |                 |

each presided over by a Vice-Admiral, bearing the title of *Prefet Maritime*.

#### *Great Britain.*

From Cherbourg we again take

"Our heritage, the sea,"

and return home. I will not occupy your time with our British Administration. It is known far better to you than to me. I have endeavoured to lay before you the naval and military strength of continental nations. You are all mentally comparing our position with theirs. Permit me briefly to aid you.

The inherent delight of Englishmen is to depreciate themselves, to condemn their own institutions. Nor is it an exercise, moderately indulged in, that can seriously mislead the earnest student of English character. Of late, however, the Army, and, in a minor degree, the Navy, have been the victims. It may be that the Services are in many points defective, but, nevertheless, half a million Britons are ready to die for their country. It is true that three-fifths of these are but moderately trained troops of reserve, that more than one-fifth are abroad; but it is a fact—a fact not communicated by any official, but



a fact ascertained by one, whose name, were I to mention it, would of itself import truth—that an army corps of 50,000 regular troops, complete in all its branches, could within a week set sail from our shores.

You are incredulous. You ask of what material the Army would be composed; to whom would the defence of the kingdom be left? Well, the Army would be composed of troops equal to any of the same number that could be brought against them. The other day, a distinguished Field Officer, formerly in the Guards, went to Aldershot full of conviction that we had no fighting men. He returned home at night, glad that he went to see for himself, and determined not again to give heed to alarmist cries. Last month, when at Aldershot, I made every effort to ascertain from regimental Officers, if they were in such despair about their men, about their recruits. In no single instance did I succeed. Why, then, is there this agitation against every detail of our administration. I will tell you, and not in my own words, but in those of a foreign Officer of no less experience than capability of observation:—

“Whenever anybody, any civilian, any officer, any private, sees, or fancies he sees something which might be improved; whenever he is aggrieved, or fancies himself aggrieved by any fundamental rule or administrative order, he throws his complaint, often exaggerated, often unfounded, into the columns of the Press. Questions are put in the House of Commons, and others desirous of giving their grievances, their suggestions, like notoriety follow in the same train. No foreign Government could tolerate such a system. Think you that no autocratic order ever emanates from the German War Office; that no Prussian soldier unable to bear the weight of his pack faints on the march; that no Russian is ever too severely punished; that no Austrian ever receives a bad and tardy ration? Such things must happen in the case of any large body of men, always have happened, always will happen, but no editor at Berlin, Petersburg, or Vienna would venture to comment on such ordinary occurrences. The growing system of running down the Army on all occasions must produce, aye, is producing, a most pernicious effect. Remember what that keen observer Baron Stoffel wrote concerning the causes of superiority in the Prussian service:—‘Nothing is omitted which is calculated to give the Army confidence in itself, to cause it to be honoured, to surround it with every possible consideration. All favours are reserved for it, and everything tends to give it, in the eyes of the nation, and in public opinion, the character of a glorious institution.’ Nor lay less to heart what H.R.H. the Duke of Cambridge remarked the other day, a dictum which should be hung up in every place of discussion, in every newspaper office within the United Kingdom. ‘If persons go on driving into the minds of the men that they are mere riff-raff, it tends to break the spirit of the Army, and the Officers are in danger of beginning to think so, too, and thus the whole organisation of the Army may be deteriorated.’”

I said just now, that every available regular soldier might be sent

out of the kingdom. The Militia regiments, for the most part full of robust, developed men, for the most part of unprecedented efficiency, giving a force 150,000 strong, admirably officered, form a reliable second line—a second line which, with a little handling would, in the case of a popular war, be available for service in the field. This is no idle hearsay, and let me tell you, that there is a brigadier at Aldershot, a brigadier who has filled high places, who will, if occasion arise, hold high command, and who believes firmly in the efficiency of the Militia. Enforce the ballot, make the Militia liable to serve abroad in time of war, organise reserve field artillery and transport, give the recruits three months' additional training; let Government have a right to purchase at a fixed sum all untaxed horses, and a vast Army will always be ready to uphold the honour of England. The moment is opportune. Preparation and acute diplomacy must do the rest. Then will our influence return. Then there will come a period of unbroken peace.

Yet if we should be called upon to put forth our strength to aid our allies, to insist on quiet, the embodied Volunteers will defend our shores. Business, even then, would suffer far less than in the markets of armed nations. I cannot but believe that the reflections recently made in this theatre with respect to the Volunteers—the 150,000 who give, gratuitously give, time, trouble, and money, to acquiring such a military foundation as must, if ever seriously built upon, prove of immense value—were hastily conceived, and are wholly unsupported by the country.

The Volunteers of Great Britain, I submit,—backed as I am by more than one reliable authority,—are the finest body of men of their class in Europe, and far superior to any *Garde Nationale* on which, as we have seen, some nations stake their safety—an institution without its equal, without its parallel in history; and, looked upon alone as a recruiting field for the Army actively engaged, its value is inestimable, and the movement cannot be over-encouraged, over-fostered.

Now, Gentlemen, for the Navy—the Royal Navy of England, which in the well known words of Sir William Blackstone, “hath ever been its greatest defence and ornament; its ancient and natural strength —the floating bulwark of our island.” Look at the figures in the accompanying table. As regards the British Navy, they are, I believe, correct, and they speak volumes for themselves.

## THE NAVIES OF EUROPE.

Country.	Vessels afloat, including ironclads.	Vessels building, including ironclads.	Guns.	Men.
Austria .....	47	10	250	12,834
Denmark .....	31	1	291	3,700
England .....	586	29	6,250	60,000
France .....	336	35	1,666	29,851
Germany .....	60	10	542	9,528
Greece .....	20	none	210	1,076
Holland .....	113	none	981	7,250
Italy .....	74	3	610	22,000
Portugal .....	48	6	288	3,520
Russia .....	297	2	1,663	31,000
Spain .....	75	3	835	25,400
Sweden and Norway .....	65	5	491	5,100
Turkey .....	110	6	1,282	65,570

N.B.—The above data are only approximative.

*Summary.*

And now to summarise briefly the results of our observation.

Of the fifteen States of Europe, seven have introduced universal liability to military service—Germany, Russia, Austria, France, Italy, Denmark, and Switzerland. The armies of seven are recruited by conscription, or conscription and enlistment, viz., Spain, Turkey, Sweden and Norway, Holland, Belgium, Portugal, and Greece, while in England alone are we solely dependent on voluntary enlistment.

Looking at the armies of Europe from every point of view, the rapidity with which they can be mobilised; fed from reserves concentrated on any point, and maintained in the field, they may be ranged in the following precedence:—

1st Class.	{ (1.) Germany. (2.) Austria. (3.) Russia. (4.) France.	3rd Class.	{ (9.) Sweden and Norway. (10.) Holland. (11.) Denmark. (12.) Spain. (13.) Portugal. (14.) Switzerland. (15.) Greece.
2nd Class.	{ (5.) Italy. (6.) England.		
3rd Class.	{ (7.) Belgium (8.) Turkey.		

Altogether four armies of the first class, two armies of the second, and nine armies of the third, with, in round numbers, a paper strength of seven and a half millions, and a combatant strength of five millions, with 15,000 guns, and a million and a quarter of horses.

In navies Great Britain is supreme; then come in their order, France, Russia, Turkey, Austria, Germany, Italy, Spain, Holland, Denmark, Sweden and Norway, and Portugal, with an aggregate total of 2,039 vessels, of which 209 are ironclad, the whole being manned by

some 280,000 men, and armed with 15,000 cannon. 110 ships of war are building in European dockyards, and of these 56 will be armoured-plated.

The expenses incidental to the Armies and Navies of Europe exceed 112 millions sterling per annum, of which fully three-fifths are devoted to the land forces.

Turkey and Austria keep their troops at the least cost, viz., at about £29 a year per man; the maintenance of the British soldier is the dearest, close upon £100 per annum. But then he is of the bravest and the best, so Gentlemen, with much gratitude for the courteous hearing you have given me, in taking leave of you, Sir William, and of "The Armed Strength of Europe," do I say that I am thankful to belong, in however humble a sphere, to

"This fortress, built by Nature for herself  
Against infection, and the hand of war;  
This happy breed of men, this little world;  
This precious stone set in the silver sea,  
Which serves it in the office of a wall,  
Or as a moat, defensive to a house,  
Against the envy of less happy lands,  
This blessed plot, this earth, this realm, this England."

### Appendix.

#### THE ARMIES OF EUROPE.

Country.	Combatant.			
	Infantry.	Cavalry.	Guns.	Horses.
Austria .....	798,172	62,746	1,616	172,981
Belgium .....	130,000	7,500	152	13,800
Denmark .....	36,050	2,100	96	9,800
England .....	359,650	29,081	1,402	70,000
France .....	463,690	45,886	1,796	161,917
Germany .....	984,281	94,674	2,472	270,920
Greece .....	100,000	450	50	2,163
Holland .....	90,260	3,850	108	10,000
Italy .....	447,264	15,850	1,240	82,153
Portugal .....	58,000	5,300	116	7,500
Russia .....	752,095	172,743	2,768	348,101
			including 400 mitrailleuses.	
Spain .....	152,000	13,000	228	30,000
			including 30 mitrailleuses.	
Sweden and Norway ....	152,800	10,540	322	20,700
Switzerland .....	174,065	4,564	294	—
Turkey .....	353,551	21,275	648	59,945

N.B.—The above data are only approximative.

## LECTURE.

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Wednesday, June 23, 1875.

GENERAL SIR WILLIAM J. CODRINGTON, G.C.B., Colonel  
Coldstream Guards, in the Chair.

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### THE COMPANY AS A MILITARY BODY.—ITS ESTABLISHMENT.—THE BEST NUMBER OF COMPANIES IN THE BATTALION.

By Colonel SIR LUMLEY GRAHAM, Bart.

INDIFFERENT as the British people has generally shewn itself to matters concerning the organization of armies, there are two great military questions which have of late years occupied a large share of public attention, having been much discussed in Parliament, and in the newspapers, besides furnishing a theme for many pamphlets and essays.

I refer, firstly, to the question of appointment, promotion, and retirement of officers; secondly, to that of recruiting and reserves.

These two subjects belong to a class of universal interest, involving, as they do, not only military but also political and social considerations, and containing within themselves problems, upon the right solution of which depends the very existence of the army and of the empire.

The question upon which I have the honour of addressing you now is neither of such vital importance, nor of such general interest. It is purely and simply a military question about which few civilians will trouble their heads. Still, for us soldiers it is, I believe, a most important question, and one which has not been sufficiently studied in this country, even by the profession.

Great Britain is *par excellence* the country of companies in a non-military sense, but I do not think that the company, as a military body has ever been held in proper estimation amongst us; moreover, I think that of late years, owing to various causes which I shall notice further on, it has been declining in importance, whilst in foreign armies it has, in obedience to what I conceive to be sounder military principles, been steadily rising in value. Holding these

views, I believe the present state of things to be detrimental to the efficiency of our Army, and especially of our infantry, and I have sought an opportunity for advocating the cause of the company, for promoting a full discussion of the subject by competent persons, and for eliciting the various opinions which may be held both upon the main point, *i.e.*, the value which should be assigned to the company as a military body, and upon the two minor points upon our notice board, our conclusions as to which must be in a great measure based upon our decision with regard to the first part of the subject. This opportunity has been afforded to me by the Committee of the Royal United Service Institution, by their kind acceptance of my offer to read a paper on the subject, for which I tender them my thanks. At the same time allow me to say, Sir, that your presence in the chair is extremely gratifying to me, not only on account of the honour it confers upon me, but also because I hope to induce you to give us the benefit of your opinion upon the matter before us, thereby setting an example which will, I trust, be followed by some amongst the able and experienced soldiers present, in which case we shall not spend this afternoon unprofitably to the service.

In order to form a just estimate of the value of the company as a military body, it will be as well to commence by giving a glance at its previous history in this, as well as in other countries, at the causes which have contributed to increase or diminish its importance, and at the position which it at present occupies at home and abroad.

A lover of antiquarian research might perhaps point to Jethro, the Priest of Midian, as having originated regimental organization, when he suggested to Moses the appointment of "rulers of thousands and rulers of hundreds, rulers of fifties and rulers of tens," but his organization was rather for civil than for military purposes; and I believe that the first example we have of the *company* as an organized military body is in the standing army of ancient Rome, and strangely enough, this "remote progenitor" of the modern company had thus early attained a completeness of development from which its descendants for many centuries receded, only now in these latest times holding out hopes of returning to the original form.

For what was the "maniple" with its 200 men (the establishment in Cæsar's time) commanded by its 1st and 2nd centurions, but the strong company of the present day, with a 1st and 2nd captain, or the double-company, both of which forms have now their advocates?

The maniple, however, does not appear to have had any tactical independence, being merely used as a convenient fraction of the cohort (or battalion), for purposes of discipline and administration. The word "company," now domesticated in all the principal European languages and used in a great variety of senses, was originally invented as a military term, I don't know exactly when, but certainly by the commencement of the 6th century, for, according to Grose, it is used under the form "*companio*" in the Salic law which was proclaimed, we are told, in 511. The word "*companio*" was compounded, say the etymologists, from the two Latin words "*cum*" and "*panis*," being at first, and for long afterwards, exclusively applied to



a body of armed men raised and commanded by one leader. They took their bread, or as we should say, messed together—"cum," "panis,")—shared the same fortunes, and were subject to the same discipline, being in fact comrades or companions.

Standing armies had ceased to exist. Until their revival, and indeed for some time afterwards, companies both of horse and foot were raised for service in the field by nobles, knights, and military adventurers, being generally disbanded on the completion of the particular enterprise for which they were raised, except in the case of corps like the "free companies" which went from one theatre of war to another, selling their services to the highest bidder, holding together as long as their leaders were fortunate, and making on the whole a very good thing of it. The strength and composition of these companies varied greatly according to the requirements of the employer, and to the means and influence of the commander.

In England the word "company" does not appear to have been in use, as a military term, before the end of the 16th century, but the *thing* was well known, and there was a nearer approach to the comparative uniformity of modern organization here than on the continent before the revival of standing Armies. For, besides its feudal levies, England had its militia, which, according to Grose, when called out for service, was divided by Officers, called "Arrayers," into thousands, hundreds, and twenties, representing what we should call battalions, companies, and squads. All mediæval military bodies, being usually raised only for a temporary purpose, must have been more or less wanting in that cohesion which is the great element of strength in permanent formations, and which is the principal cause of the superiority which standing Armies possess over militia and other levies temporarily embodied.

Still, whilst embodied, the men of a company took their bread together, and were bound together by that great bond of union—*comradeship*—the first great moral agent which gives a special importance to the company, for this same feeling of comradeship can hardly extend to a wider sphere. When I speak of comradeship, be it understood, I refer, not only to the intimacy existing between the men of the same company, but also to that which exists, *mutatis mutandis*, between Officers and men.

Of course, when standing Armies were formed, the feeling of comradeship became intensified in the company as its members served longer together; and however great the ravages of war or disease, there were always some of the old lot left to carry on the company's traditions. Thus, too, with the revival of standing Armies, came also the revival of a moral agent not unknown to the Armies of ancient Rome, one which, however, is not confined to the limits of the company, but which has a much wider sphere, extending to the battalion, regiment, brigade, division, nay, even to the whole Army—a feeling which is, happily, very prevalent amongst us, though, oddly enough, we have no English term for it, and are obliged to borrow one from the French, namely, "*esprit de corps*."

The company, then, has the advantage which, as I maintain, no

larger military body possesses, of being acted upon by both these great moral agents, "comradeship," and "*esprit de corps*," and this powerful, double moral influence has affected the company, to a great extent, ever since the formation of standing Armies, thus giving it a great importance for purposes of training, discipline, and administration, whilst adding largely to its fighting power.

For a long time, however, even after the creation of standing Armies in modern Europe, this moral influence was necessarily impaired by the uncertainty as to military establishments which prevailed, more or less, in all countries, and the full development of the company's importance in this and, as I shall presently show, in other ways, has been reserved for the age in which we are living, and especially for the very latest days, if, indeed, that full development has yet been attained.

The system of permanent cadres now adopted, or in course of adoption, by every nation having any pretension to an Army, has imparted the permanency which was before wanting in military bodies, and which was required to complete the moral influences which, as we have seen, work so powerfully upon the company.

But its value has been raised, to a still greater degree, in another manner.

The maniple had, as I have already remarked, no tactical independence in the standing Army of Rome, and the same became the case with the company when modern standing Armies were formed, companies being united into regiments, the latter being afterwards subdivided into battalions, and independence of action, on the part of the company and its commander, being discouraged, or only permitted under very exceptional circumstances. The object was to impart cohesion to as large a mass as possible. The attack of cavalry was much feared, the effect of fire-arms being comparatively slight, and solidity was cultivated at a great sacrifice of mobility. Frederick the Great, indeed, imparted the latter quality to his Armies; at least, their marching and manœuvring power was great in comparison to that of the Armies opposed to them, but this comparative mobility was attained by perfection of drill and discipline, which enabled the commander to handle a long line of many regiments as one body. Thus, the regiment and the battalion lost much of their individuality, as had before done the company, and the latter made no progress as a tactical body. Frederick, however, appears to have recognized its value in other ways, for he sought to add to its efficiency by augmenting its cadre to fourteen non-commissioned Officers, that of an Austrian company at the same period consisting of six.

(I am indebted for this fact, and for some others mentioned in the course of this lecture, to General Renard's valuable little book on "Infantry Tactics," published in 1857.)

For many years after Frederick the Great's death, the so-called linear tactics which had with him proved so successful, were imitated by every European Army, and took such firm root that, in face of altered conditions of warfare, and though over and over again proved wanting and generally set aside in practice, even by those who

advocated them in theory, their spirit still haunts the parade-ground, and lingers more or less sensibly in the drill books of every European Army.

In the latter half of the 18th century, however, a school of tacticians was formed in France, who, in spite of drill regulations modelled on those of Potsdam, initiated what is called the "perpendicular" system, which powerfully contributed to the victories of the Republican and Imperial Armies. This school, of which De Broglie, Kellermann, Dumouriez, and Custine were members, all Officers who had bought their experience in the Seven Years' War, and were not blinded by the victories of the great king to the serious defect inherent in his tactical system, namely, the want of independence allowed to the minor units, that school was reinforced by Rochambeau, Lafayette, Jourdan, and the brothers Berthier, who came fresh from the American battle-fields, where they had learnt to appreciate the action of skirmishers, limited though it then was by the comparative inefficiency of fire-arms. The new French tactics, requiring much greater pliability, necessitated the employment of smaller tactical units than those hitherto in use, whilst the habit at the same time introduced of fighting on all sorts of ground, and in extended order, instead of confining the conflict to open plains where men fought shoulder to shoulder in unbroken lines, which had been the general practice under the old system, contributed to the same result by rendering supervision more difficult, and by necessarily giving greater independence to inferior Officers.

Thus commenced a new era for the company, which then for the first time since it had lost its independence by being merged in the battalion, became a tactical unit. But though the French deserve the credit of having led the way in this matter, they do not seem to have appreciated the importance of developing the force of the minor unit which their system of tactics may be said to have created.

The company made but little progress in France under the Republic and Empire, whilst in other countries it occupied a still lower position, the Potsdam principles being generally adhered to.

The Prussians above all held on, as was to be expected, to their famous linear system, to the principle of the "bar of iron," which, to use Baron Ambert's well-known metaphor, was found wanting when opposed to the "flexible chain" of the French. Jena first opened their eyes, and after the peace of Tilsit, a commission, of which the illustrious Scharnhorst was the inspiring genius, drew up a new system of regulations, which were issued in 1812, and remained in force, I believe, till 1847. These regulations gave greater tactical importance to the company, and laid great stress on skirmishing. Still the battalion was not rendered flexible enough to satisfy the far-seeing race of soldiers which had now grown up in Prussia. Reflecting, doubtless, upon the dearly bought experience of the Napoleonic wars, and upon the alterations in tactics likely to be produced by the inventions of Delvigne, Thouvenin, and Dreyse, which were in course of elaboration, they invented the company column, first introduced officially into the Prussian Army in 1843, and rendered a permanent

institution by the drill book of 1847.<sup>1</sup> Its merits were conclusively established in the battle fields of Bohemia and of France in 1866 and 1870-71.

There are probably many among my hearers who have made themselves acquainted with the tactical system of Prussia by personal observation. There are, doubtless, few who are not more or less acquainted with the Prussian drill regulations, and with the works of May, Boguslawski, Du Vernois, Von Scherff, Kühne, and other German writers, who describe the working of the company-column, both on the exercise ground and in action. It will therefore not be necessary for me to enter into details, even if I had the time to do so. Suffice it to say that all the battle-formations of the German Army, under Prussian inspiration, are now founded upon the "Company-column," and upon the principle that "individual order," to use their new phraseology, has supplanted the "order of masses." Hence in the German Army the company has become the most important unit of combat, and enjoys a degree of independence hitherto not allowed to it in any other Army except in that of Sweden, which has not had the opportunity of testing its efficacy in action. It is only fair, however, to state that the effects of this independence have been somewhat dreaded by many of the most experienced German officers, and that attempts have been made by regulation and precept to keep it within narrow bounds, but in vain, for throughout the great wars of 1866 and 1870-71, the company established its pre-eminence as a battle-unit on all occasions, and tactical regulations, suitable only to an earlier state of things, were compelled to give way to the necessities arising from the changed conditions of warfare.

Fortunately for the Prussians the excellent company system which had for years been growing up and perfecting itself, gave them special facilities for adapting themselves to the new order of things, and enabled them to adopt, as it were, impromptu the "individual" system of tactics which makes such great demands on company-efficiency. For as the company rose higher in estimation as a fighting body, so more was necessarily expected of it, and the fact became recognized that it would be unable to perform its task efficiently unless it possessed a perfection of training and discipline, and of inter-reliance between its members of all ranks, only to be attained by the most careful supervision and the most unremitting exertion on the part of officers and non-commissioned officers, seconded by the willing obedience of the men. The whole tendency of German company regulations is to render the Company as independent and complete in itself as possible, to make the men look up to their own officers and non-commissioned officers with the greatest respect and trust, and above all, to make them consider the Captain (the company-father as he is sometimes called), the man of most consequence to them in the whole Army, whilst the Captain by the constant habit of responsible command, and by the constant study and practice of

<sup>1</sup> Though the Prussians deserve the credit of inventing the company-column, they probably took the idea from Ménil-Durrand's double-company-column, advocated by him in 1770.

his professional duties, gains the quickness, decision, and self-reliance necessary to enable him to play the important part assigned to him in the field. There is only one way of attaining these objects, and that is to give the Captain the power, responsibilities, and consideration which have hitherto been only granted to him fully in the Armies of Germany and Sweden. All the other Continental Armies are now adopting, more or less completely, the same system. Of course it does not necessarily follow that that system is the best, for we are all very apt to imitate successful people merely because they have been successful, without investigating the causes of success; but I think that in the present instance investigation will show that the imitators are right, and that the Germans owe their recent triumphs in great measure to their careful development of the company, which enabled them to carry out effectively their present system of tactics, a system, the general features of which, at least, every Army will, I doubt not, be forced to imitate in war, whatever may be its drill regulations, and despite of them if necessary. Happy will it be for those Armies which have already been learning in peace what they will have to practise in war, and in which the company occupies its proper position as a military body.

With us, I think, it has never done so, and it does so less now than ever, for of late years it has certainly lost ground relatively if not positively. *Relatively*, most certainly, because notwithstanding what recent experience shows us to be the present conditions of warfare, the company has not been raised as it has been elsewhere into the position of a tactical unit, neither has it hitherto received the sort of training fitted to prepare it for that position. I think that it has also declined in *positive* value as a military body, first, because our Captains have lost much of their influence, never sufficiently great, through the constant and increasing interference from without. Instead of looking up to his Captain as his paramount chief, after the fashion of the German soldier, the Englishman knows not whom he should most honour and obey. For the first few months of his service, the Adjutant, sergeant-major, and drill instructors, are the gods whom he must worship, and to the first two at least he must look up with particular awe throughout his service. As time goes on, he falls into the hands of the musketry instructor and his sergeant, to whom he has to pay his devotions annually. Then comes the gymnastic instructor. In fact, he has so many masters beyond the limits of the company that his allegiance is too much divided, and he cannot have much reverence to spare for his Captain and the other company-Officers who instruct him only in the ordinary routine of his duty, whilst all that is unusual, and specially calculated to awaken his interest, comes to him from outsiders.

In like manner the young company-Officers have more to do with the Adjutant and sergeant-major than with their Captain, and later on they go for instruction in the higher branches of professional knowledge not to him but to a garrison instructor, thus going not only beyond the limits of the company, but beyond those of the battalion. As for the non-commissioned Officers, throughout their career, they are far more dependent on the regimental Staff than on the Captain,

whose good opinion is not nearly so important to them as that of the Adjutant. A good deal of what I complain of has grown up of late years by necessity. Improvements in fire-arms, and the general advance of military science, rather took us by surprise, and regimental Officers had not as a rule the necessary amount of professional knowledge. Hence specially trained Staff Officers were appointed, to whose zeal and intelligence the service has been much indebted. But thanks to their efforts, to the School of Musketry, and to what I think I may call the great military revival which has taken place amongst us, I hope that the time will soon come (if it has not already arrived), when the services of these special Officers may be dispensed with, and the whole responsibility of the professional education of subalterns, non-commissioned Officers and privates, may fall upon the Captain, as it does in Prussia, not excepting that portion of it which now devolves upon the regimental Adjutant, an Officer whose position is unique, for I do not believe that a subaltern in any other army occupies so high a position, and has so much influence as falls to the lot of our Adjutants. Now, I have a great respect for the British Adjutant; he is almost always a good Officer, and when he rises in rank, the experience which he has gained on the regimental staff proves most valuable to him, and I doubt not that a large proportion of our ablest Generals have been regimental Adjutants. Still I should like to clip his wings, for they overshadow greatly his brother Officers, particularly those whom I think we should do much to elevate, namely, the Captains.

My time is too short for me to enter into minute details upon this subject even if it were advisable in other respects to do so. But I will refer to one point, in which a change for the better has been made of late years with regard to the Captain's authority; namely, the increased power of punishment which has been given to him. This appears to me to be a step in the right direction. The foregoing general remarks will, as regards the rest, be, I hope, sufficient to indicate the policy which, in my opinion, should be pursued in order to give our company its due importance as a military body.

I spoke at the beginning of this lecture of more than one cause which has tended of late years to lower the position of the company. I have just enlarged somewhat at length upon what appears to me to be the chief cause.

There are two other causes, however, of great though of minor importance concerning which a few words must be said.

Up to the middle of this century, the British infantry was broken up into small detachments. There were few stations at home at which more than one battalion was stationed, and few battalions which had not some of their companies detached. This state of things, prejudicial as it was in many ways, had at least a good effect in adding to the responsibilities and influence of the battalion and company-commander, each in his own sphere. The greater concentration of troops which has been effected during the last twenty-five years has doubtless done good on the whole, but it would have done good unmixed with evil if due care had been taken to check the rage for centralization which has affected perniciously both the battalion and the company.



Again, another cause of weakness in the company has been the smallness of the home establishment generally maintained.

This has seriously affected the company both with regard to discipline and instruction. It has been impossible to carry out in earnest the squad system which we all know to be so essential to the former, whilst the number of men available for the latter is generally so small that company-drill is out of the question without an intermixture of companies. Hence company-drill, properly so called, is rarely carried out, which materially lowers the influence of the Captain and the value of the company as a military body. This difficulty of establishments is easily overcome (the change being accompanied by no increase of expenditure) in a manner which I shall point out further on. But before proceeding to consider that branch of my subject I wish to add a few words upon the main part of the question as concerning ourselves.

I believe, as I have said before, that the company has never occupied its proper position in our Army, but I ought to have added the words "in peace time," for our troops have so often been engaged in mountain warfare and other similar operations which make special demands on the smaller military bodies, and on the individual soldier, that the company has been called into independent action more frequently with us than with the soldiers of any other European nation, until the recent tactical changes. And nobly have our companies done their work on the whole; still, if we study the history of our "little wars," we shall almost always discover traces of the want of previous individual training which can only be acquired under a good company-system. Our companies struggled against the difficulties created by this deficiency, and almost always with success in the long run, meanwhile, however, suffering much loss and sometimes incurring disaster.

Unfortunately our Army did not profit by experience, and the same sort of thing was repeated over and over again.

There have, however, been cases amongst us in which Commanding Officers who have been in advance of their age have appreciated the importance of the company as a battle-unit, and who have prepared the troops under their command in peace for the part they would have to play in war. I will allude to two such cases, the first being a matter of history well known to you all. I refer to the famous Light Division, which owed much of its superior efficiency in war to the careful training and discipline of the Shorncliffe Camp, under Sir John Moore, an essential feature of whose system was to develop the importance of the company as a military body. The lessons first learnt at Shorncliffe, and afterwards impressed upon that splendid body of soldiers by many years of practice in the field, had not been quite forgotten by their descendants when I joined one of the famous old regiments of which the division was composed. In it, and, I believe, in its sister corps, the old company-spirit was pretty strong, and contributed much towards maintaining a high standard of efficiency under adverse circumstances.

Another case to which I would refer came under my own observation.



I allude to the 73rd Regiment, quartered at the Cape of Good Hope, under command of Lieutenant-Colonel (afterwards Major-General Sir William) Eyre, before and during our last Caffre war. That able Officer prepared his battalion with the greatest zeal and energy for the work which he foresaw it would probably have to perform; and, above all, took the greatest pains in training his companies to independent action.

The result justified his foresight, for throughout the war which ensued, the 73rd Regiment, though employed more than any other in the country, never, I believe, met with a check, and certainly inflicted more damage on the enemy than did any other corps.

The efficiency and self-reliance of both Officers and men in the field were very remarkable, and presented a strong contrast to the action of regiments fresh from home, which at first showed more or less want of real military instruction, a want which, in some cases, entailed severe loss. They learnt by experience, and all did their work well in the end, but they bought their experience dearly.

Having thus given my estimate of the company as a military body, with some illustrations drawn from previous history, I will turn to the second part of my subject and consider how the establishment of the company affects its value in peace and war, and what appears to be the best number of companies to unite into a battalion.

Until the latter part of the 18th century, when, as we have seen, the company rose into the position of a tactical unit, the military authorities of all countries seem to have been guided by no fixed principle in matters relating to company and battalion organization. If we examine the records of our own oldest regiments, we find a tale of alternate reduction and augmentation effected sometimes by adding to or diminishing the number, sometimes by increasing or reducing the strength of companies, sometimes by both processes. Military efficiency appears seldom to have been considered in these arrangements which were often affected by favouritism and by respect for vested interests. Nor does the case appear to have been very different abroad during the 17th and most of the 18th century; the establishment and number of companies were constantly varying.

In the latter part of Frederick the Great's reign, the Prussian battalion consisted of five companies formed for manœuvre into eight divisions, a curious and complicated process. In 1792 the French battalion had nine companies including one of Grenadiers. Soon afterwards as the practice of skirmishing gained ground, a tenth company, that of Voltigeurs, was added, the two flank companies being composed of picked men and specially employed for tasks of particular difficulty and as light infantry. This system was imitated by most of the European armies including our own, and remained in force until the general introduction of arms of precision, and the consequent extension of fighting in skirmishing order caused the abolition of flank companies.

At the commencement of this century the strength of companies ranged from 100 to 150, the flank companies being generally somewhat stronger than the others.

We have seen how the French led the way in raising the value of the company by giving it tactical importance. About the same time the Prussians introduced a change in battalion organization which has, I believe, in no small degree contributed to give the company the high position which it now occupies in Germany. In 1787, the year after the death of Frederick the Great (I am indebted for this date to General Beauchamp Walker), the four-company formation was introduced. It has been maintained ever since in Prussia, and is now, as we shall see presently, being adopted in all the great armies of the Continent.

I believe that the change of organization was due, in the first instance, not to considerations of military efficiency, but rather to motives of economy, for it does not appear to have resulted in any immediate tactical improvement; and it was doubtless accompanied by a considerable reduction of Officers and non-commissioned officers, retrenchment in military expenditure being just then the order of the day in Prussia. But, as time went on, and as the value of the company became better understood, the great advantages, consequent on the system adopted in 1787, became evident, and it was maintained for reasons very different from those which led to its first introduction.

From the date of the French revolutionary war, all nations appear to have become more systematic in their arrangements as to military organization. The French for some time adhered to the ten-company formation, for which they afterwards substituted that of eight, and in later times that of six, in which they fought their last battles.

I have not ascertained what was the formation of the Austrian and Russian battalion during the Napoleonic wars, but in later days, up to 1866, the former consisted of six companies formed for manœuvre into three divisions, each company being divided into four sections, whilst the latter had at the time of the Crimean war, four companies each of two sections, No. 1 company being composed of picked men, and one of its sections forming on each flank of the battalion. The strongest regiment engaged at Inkermann mustered, according to Todleben, an average of 244 men per company; the weakest an average of 198 men. The Russians had, shortly before the Crimean war, adopted the Prussian company-column formation, but fortunately for us, in the letter and not in the spirit, for there was very little of that independent self-reliance in the Russian companies which characterises those of Prussia. Since the war of 1866, the Austrians have adopted the four-company formation with establishments similar to those of Prussia, and their last regulations give an importance to the company, not inferior to that possessed by it in the army of their great neighbour. After the Crimean war, the Russians added a company to their battalions which were thus made to consist of four battalion-companies, and one light company. This formation has been maintained ever since, but I saw in the "*Revue militaire de l'Etranger*," (number of the 16th April) that the 5th companies were by degrees to be abolished, so that battalions will again consist of four companies, but without any distinction between them, a much

more rational plan. The war strength of the present Russian Company is about 190.

Italian battalions used to consist of six companies, after the fashion of the French, but Italy has lately adopted the Prussian plan, after a thorough discussion of the subject in Parliament, and the Italian company is fast attaining the importance enjoyed by those of Germany, Sweden, and Austria.

The French have been much divided in opinion upon the subject. Ever since the late war there have been amongst them many advocates of the Prussian company-system, but also many strong opponents to it, some of the latter being, I think, somewhat influenced by their prejudice against anything coming from the other side of the Rhine. However, the question was most fairly and exhaustively discussed upon its merits in the National Assembly at the beginning of the year. The debate is given fully in the "Journal Officiel," and is both interesting and instructive. It has resulted in the adoption of the four-company battalion, with a war establishment resembling that of Germany, but with what appears to me an insufficient peace establishment, insufficient, I mean, to maintain the efficiency of the Company, which will on the peace-footing be composed as follows:—

Officers 3.				Non-commissioned Officers, 14.			
Captain	..	..	1	Sergeant-Major	..	..	1
Lieutenant	..	..	1	Quartermaster Sergeant	..	..	1
Sub-Lieutenant	..	..	1	(Fourrier)	..	..	1
				Sergeants	..	..	4
				Corporals	..	..	8
Drummers or buglers	..	..	..	..	..	..	2
Privates, including 2 pioneers	..	..	..	..	..	..	66
Total, all ranks	..	..	..	..	..	..	85

The cadre is out of all proportion to the number of privates, so as to allow for partial expansion for the annual manœuvres, and for augmentation to the war footing, which would raise the number of privates to about 200, the cadre being then also increased by 1 subaltern, 1 quartermaster-corporal (caporal-fourrier), 4 sergeants, 8 corporals, 2 drummers.

And now let us turn to our own country and see what we have been doing in this way since the beginning of the century. During the "great" war, as we English may still call it, our service battalions consisted generally of ten companies of about 100 men.

(By the way, I will only deal with the service battalion, as I have no time to enter into the dépôt question, though it should properly be a branch of my subject.)

Since 1815 more attention has been paid to military considerations as affecting company efficiency than was the case before the war. The service-battalion has consisted at different periods of six, of eight, and of ten companies, each of which arrangements may have been

good as long as it was allowable to adhere to the system of tactics under which Wellington's armies fought and conquered. Of course during the Crimean War and the Indian Mutiny, the only great wars in which this country has been engaged since 1815, every other consideration gave way to those of a military nature, and the establishments were suited to our supposed requirements; but in the long intervals of peace this has not generally been the case, and military efficiency has too often been subordinated to political expediency and to the exigencies of party. Thus there have been statesmen on both sides of the House who inveighed whilst in opposition against the parsimony and neglect of those in office, and who, on succeeding to power, have, after a decent interval, done their best to vie with their predecessors in the art of retrenchment. I think we have reason to hope that those times are over, that the question of the national defences will no longer be discounted for party purposes, and that all parties will agree that there is no true economy without efficiency, and that the latter is not a plant which springs up all at once, but that it is the result of constant care and cultivation. Meanwhile party strife has often been productive of evil to the British Army, and has in great measure been the cause of the constant fluctuations in our military establishments, which it has been the policy to reduce to the utmost minimum compatible with bare existence, except when the state of foreign affairs has produced a momentary panic, and its consequence, army augmentation. Of late years, however, as public opinion in this country has become more enlightened upon military matters, the conviction has been gaining ground that such things should not be left to chance and to the caprice of the moment, but that both the peace and war establishments of our military bodies should be, as far as possible, permanently settled, in accordance with the practice now prevailing throughout Europe. Arrangements of this nature have been made, and the result at present is as follows, as far as concerns the question before us:—Our service-battalions consist of eight companies, the peace establishment of the latter ranging (as is necessary, I suppose, in consequence of the peculiar exigencies of our foreign peace service), from—

*Lowest Peace Establishment.*

- 1 Captain, with one or two subalterns.
  - 4 Sergeants, including colour-sergeant,
  - 2 Drummers,
  - 5 Corporals,
  - 60 Privates, including 1 pioneer and, on an average, 3 musicians,
- Making up a total per service battalion of  
605 all ranks, to—

*Highest Peace Establishment.*

- 1 Captain, with two or three subalterns,
- 5 Sergeants, including colour-sergeant,
- 2 Drummers,
- 5 Corporals,

98 Privates, including pioneer and musicians as before,  
Making up a total per service battalion of  
919 all ranks.

According to the "Soldier's pocket book," the war establishment of our service companies is fixed at

*War Establishment of a British Company.*

1 Captain, with two subalterns,  
5 Sergeants, including colour-sergeant,  
2 Drummers,  
5 Corporals,  
119 Privates, including pioneer and musicians as before.  
Total per company, all ranks, 134.  
Total per field-battalion, all ranks, 1,097, including 4 hospital orderlies.

Compare the foregoing with the peace and war establishments of a German company and battalion.

*Peace Establishment of the German Company.*

1 Captain,	1 Sergeant-Major,	115 Privates, including
1 First-Lieutenant,	1 Officer Cadet,	4 Musicians,
2 Second-Lieutenants.	4 Sergeants,	2 Reserve Musicians.
—	7 Corporals.	
4 Officers	—	
	13 non-commissioned	
	Officers	

Total all ranks, 4 officers, 128 men, besides 1 hospital orderly and 3 tradesmen, non-combatants, making per *battalion*, 18 officers and 514 men, besides non-combatants.

*War Establishment of the German Company.*

1 Captain,	1 Sergeant-Major,	6 Musicians,
1 First-Lieutenant,	1 Officer Cadet,	223 Privates.
3 Second-Lieutenants.	4 Sergeants,	
—	14 Corporals.	
5 Officers.	—	
	20 non-commissioned	
	Officers.	

Total, 5 officers, 249 men, besides 1 hospital orderly and 2 drivers, making per battalion, 22 officers, 998 men, besides non-combatants.<sup>1</sup>

I trust that you will consider me justified in making the following assumptions. At any rate I must beg you to allow me to do so, if only for the sake of argument. I will assume then—

1. That "individual order," and not the "order of masses," will, in future, be employed in battle.

2. That, in consequence, the minor units, and notably the company, have acquired a great increase of importance.

<sup>1</sup> From "Heerwesen, &c." By Lieut.-General v. Witzleben.

3. That the company is not only *the* most important battle-unit, but is also *the* great school of military instruction and discipline; in short, to use General v. Witzleben's words, "*der Grundpfeiler unserer militärischen organisation*" (the basis of our military organization); "*die Familie im militärstaate*" (the family of the military world).

4. That a wise organization is the first step towards making this "basis" solid, this "family" united.

We have before us, speaking in a general way, three patterns to choose from, each of which has its admirers—

1. That of few companies and large ones.

2. That of many companies and small ones.

3. That of many and small companies united by pairs for tactical purposes.

The maximum number of companies being eight to the battalion, the minimum number four.

To which system will you give the preference?

I myself am inclined to favour the first system for the following reasons—

1. It is the system which makes the company of most importance for instruction, for discipline, for battle.

For instruction; because it ensures the Captain a sufficient number of men to make "company drill" a reality and not a sham, promoting thus both his own military education and that of his Officers, non-commissioned Officers, and privates; and by education, I mean, as you will understand, a great deal more than *drill* or even *training*.

For discipline; because, the higher the position of the Captain, the more constant his intercourse with his men, the greater becomes his influence over them; and there has been no period since the formation of standing armies when the personal influence of the leader was as powerful an agent in war as it is now.

Moreover, in a strong company the "squad" system can be maintained in its integrity, and nothing conduces more to discipline and efficiency than a squad system properly carried out. Amongst its other advantages it serves to train subalterns and non-commissioned Officers to the exercise of responsibility, and to the habit of self-reliance. The effect of the presence or absence of such training will be clearly shown on the battle-field; for, as battles are fought now-a-days, the intelligent co-operation of inferior leaders of all ranks down to the junior lance-corporal is called into play.

For battle; because, in addition to the advantages accruing to the company in action, on account of the superior instruction and discipline already claimed, I think that the tactical advantages derived from the four-company system are great. Without going into details, for which there is no time, and which might weary you beyond endurance, the chief merits of this organization, from a tactical point of view, seem to be, firstly, that it reduces to a minimum the subdivision of command. Such subdivision being, I think, under the present conditions of warfare, unavoidable, I would reduce the number of sub-unit leaders as much as possible, both for the sake of maintaining a general unity of action, and also on account of the difficulty of finding

a sufficient number of capable leaders. But I would not reduce the number of companies per battalion below four, because we should then have unwieldy companies or too small a battalion. Secondly, that it provides us with a strong company capable of performing the part now required of it in battle, of which a weak company would be incapable, particularly after it had undergone the wasting effects of even a few weeks' campaigning.

The only argument of any weight which I have heard against the four-company system is, that it provides us with a company too large for one leader to control in action, assuming the field-battalion to be, as I think it should be, not less than 1,000 strong.

But I would reply to this objection; firstly, that the company will, from the very first moment show far fewer men on parade than the number shown on its muster-rolls, and that its fighting strength will be reduced day by day until drafts have been received from home; secondly, that the difficulty of command in battle will be much diminished for the Captain who has trained his subalterns and non-commissioned Officers to that intelligent co-operation of which I just now spoke, and which alone will render it possible to command a company efficiently in war.

As to the system of "many and small companies united by pairs for tactical purposes," in other words the "squadron" or "division" system, it seems to me radically wrong in *theory*, because the commander of the double-company in the field will only command half his unit in quarters. Over the other half, therefore, he cannot exercise the direct personal influence so necessary to his position.

In *practice*, it has been tried and has been abandoned by two of the greatest military powers, France and Austria.

Having settled, to my own satisfaction at least, that the four-company system is the best, I will propose establishments which appear to me suited to the object in view, giving my reason for any departure from the ordinary custom, and taking care to keep within our present battalion establishments.

*Proposed lowest Peace Establishment of the Company.*

1 Captain-Commandant (or Major)	} Officers 5.
1 Captain .. .. .	
3 Lieutenants .. .. .	
1 Sergeant-Major ..	} Non-commissioned Officers 20.
1 Quartermaster-Sergeant	
6 Sergeants .. .. .	
6 Corporals .. .. .	
6 Lance-Corporals ..	
3 Drummers and Buglers .. .. .	3
120 Privates, including 6 Bandsmen, 1 Acting-Bandsman, and 2 Pioneers .. .. .	120
Total, all ranks .. .. .	148



Battalion Staff Officers	..	..	..	4
Non-commissioned Officers	..	..	..	7
Battalion total. Officers	..	..	..	24
Men..	..	..	..	579

*Proposed War Establishment of the Company.*

1 Captain-Commandant (Major)	}	Officers 6.
1 Captain .. ..		
4 Lieutenants .. ..		
1 Sergeant-Major ..	}	Non-commissioned Officers 20.
1 Quartermaster-Sergeant		
6 Sergeants .. ..		
6 Corporals .. ..		
6 Lance-Corporals ..	}	4
Drummers and Buglers .. ..		
Privates, including 6 Bandmen and 4		
Pioneers .. ..		230
Total, all ranks .. ..		260
Battalion Staff. Officers .. ..		4
Non-commissioned Officers .. ..		7
Battalion total. Officers . . .		28
Men .. ..		1,023

besides non-combatants.

Many object to the idea of having two captains for the company, and I think it would be very objectionable unless you distinguished the senior from the junior both by giving him a higher title and higher pay. Call him either Captain-Commandant, or Major, and give him 15s. a day and forage for a horse, for he should be a mounted officer. With the increased amount of work which I propose to be thrown on the company, I do not doubt that plenty of occupation would be found for the Second Captain even when the Commandant is present. During his absence, of course the Second Captain would be in command. The company would be divided into three squads (or sections on parade). Each of these squads under a Lieutenant. The war establishment would give a fourth Lieutenant to provide for a casualty. I propose three instead of four squads or sections, because I think that owing to their greater strength, as thus arranged, the squad system would be more efficiently carried out, because the three-section formation appears to have some tactical advantages, and also because it demands a comparatively small proportion of non-commissioned officers.

Sections would be subdivided into half-sections, each of which under a sergeant. The half-sections would be again sub-divided into fractions, for which we must invent a name, each under a corporal.

There would be two lance-corporals in each section to assist the other non-commissioned officers. Lance-corporals should receive higher pay than privates.

All non-commissioned officers should be out of the ranks; that is to say, either as leaders of sections, half-sections, &c., or as supernumeraries. The sergeant-major would be head of the company non-commissioned officers, and would perform all the duties now devolving upon the colour-sergeant, except those relating to the charge of arms, ammunition, clothing, accoutrements and other stores, and to the supply of provisions, fuel, and such like, which would fall to the lot of the quartermaster-sergeant. As company work would be largely augmented both by the increased size of the company, and by the proposed redistribution of regimental duties, there would be ample occupation for two company staff non-commissioned Officers. I propose reducing the battalion staff by one Officer, the Quartermaster, because I think that the diminished duties of both that Officer and of the Adjutant may well be performed by the latter. I propose relieving the subaltern filling the office of musketry instructor of his special duties which may in future be performed by Captains of companies. I propose also doing away with the sergeant-pioneer, sergeant-cook, and sergeant-instructor of musketry, whose services can, I think, now be dispensed with.

The proposed change of organization would produce the following saving on the daily pay of a battalion on the lowest peace footing:—

				£	s.	d.	
By	1	Quartermaster	.. ..	0	6	6	per diem.
	1	Lieutenant	.. ..	0	5	3	
	1	Sergeant-pioneer	.. ..	0	2	2	
	1	Sergeant-cook	.. ..	0	2	2	
	1	Sergeant-instructor musketry..		0	3	2	
		Extra pay of musketry-instructor		0	2	6	
	16	Corporals	... ..	1	4	0	
	4	Drummers	.. ..	0	5	0	
Total saving				£2	10	9	

But as my motto is not "economy by retrenchment," but "economy by efficiency," I propose devoting my savings to the following purposes:—

				Per diem.	
				£	s. d.
Extra pay for	4	Captains-commandant at	3s. 5d.	0	13 8
"	"	24 Lance-corporals at	1s. 2d.	1	8 0
"	"	4 Sergeant-majors, at	6d.	0	2 0
"	"	1 Battalion ditto, at	1s.	0	1 0
"	"	1 Lieut.-Colonel-Commandant at	3s.	0	3 0
Forage for	4	Captains' horses, at	2s.	0	8 0
Total extra expenditure				£2	15 8

Leaving us *apparently* 4s. 11d. out of pocket, but *really* not so, for more than this sum would be saved on the *allowances* of the reduced Officers and non-commissioned Officers. Moreover, my establishment would provide 24 more combatants per battalion than does the one with which it is compared.

Only one word, Gentlemen, in conclusion. I have heard it said that we should never get the British Captain to do the amount of work which I have proposed to cut out for him. I believe that, speaking generally, this is a calumny upon our British Captains, and that the great majority of them would welcome what I will venture to call a reform which would give them *real* responsibility and *real* influence, though coupled with extra work. At the same time I desire to guard myself against the imputation of wishing to raise the Captains at the expense of the Colonel. Far from it. I wish to raise him in like proportion, and I believe that one sure way of doing so is to relieve him of many petty cares and duties which under our present system devolve upon him, but which should be taken off his hands by the Captains, thus leaving him more time to devote to his higher functions.

I am aware that I have not made the best of my case, having omitted much which might be said in support of my views. But I felt that the time at my disposal was too short to give more than a slight outline of the picture, which I hope those who think with me will complete, whilst those who disagree with me do their best to point out its defects.

P.S.—Since writing this paper, an important tactical memo. has been issued by order of His Royal Highness the Commander-in-Chief, upon which it would of course be unbecoming in me to make any critical remarks. But I think I may say, with perfect propriety, that I welcome this memo. as a boon to the service, because it appears to me to contain the recognition, hitherto withheld, of a tactical principle materially affecting the action of infantry in battle, also because it is a step towards that development of the company as a battle-unit which I have been advocating. I doubt not that it will soon be found that further steps must be taken, in order to make our companies equal to their new task, and that, to use the words of a recent article in the "*Revue Militaire de l'Etranger*," upon the necessity of a similar reform in France, we shall "profit by the experience of our neighbours," and whilst using the "most legitimate efforts to mould the company into an instrument for battle which our infantry does not at present possess, we shall be careful in no way to depreciate the value of that other important unit—the battalion."

The CHAIRMAN: I am sure that we are obliged to Sir Lumley Graham for having introduced this subject to our notice. I will not state my own opinions at present, as I am sure there are people here who would like to discuss it, and I hope that we shall have an interesting subject worthily handled.

Colonel the Hon. PERCY FIELDING, Commanding Coldstream Guards, said that he entirely agreed with everything that Sir Lumley Graham had stated.

Lieut.-General Sir HAMILTON GORDON: I should like to ask Sir Lumley Graham

if he can inform us what is the war establishment of a French company? He has stated the peace establishment, and the commissioned Officers and non-commissioned Officers of the war establishment, but I do not think he has stated the number of privates on the war establishment. Where do you find that?

SIR LUMLEY GRAHAM: I may as well answer that question at once. With regard to the war establishment of the French company, I think I stated that it was supposed to be made up to about the same as the Prussian war establishment. I find it only in a casual way. I do not think the war establishment has yet been finally settled; but I find it casually alluded to in that discussion in the French Chambers of which I spoke.

SIR HAMILTON GORDON: It is a remarkable thing. In the elaborate law they have issued for the organization of the French Army they omit to mention the war establishment of the company.

SIR LUMLEY GRAHAM: They do not give it in the Tables, but I inferred from a statement, I think, of the Minister of War, that the establishment was intended to be about the same as that of the Prussian battalion.

THE CHAIRMAN: This question is one of great importance to our Army. It is the introduction of a great change—a thing which, perhaps, Englishmen do not much like at first. One of the main points would be, whether the 250 men of the four-company system are not a very large number for an Officer to manage, unless you consider him as the mounted Officer commanding what we should call a battalion. In the Prussian system, the Captain is mounted nominally, but has to dismount when he is in charge of his company under fire. I do not know whether it is very practicable to command 250 men under fire, unless it is at the last moment, when you must advance with the men to the attack; because 250 men extended (which I apprehend is the first line of attack of the Prussian Army), is a large number, covering much space when extended in open order, and difficult to command on foot. I do not suppose that any one can differ with Colonel Graham, that the company is the foundation of the military system of almost every nation, and ought to be so. It is the means by which the men are known to the Officer who commands, more particularly if he pays them, and is in the habit of that constant communication that takes place between them. The double Company is rather excluded by Colonel Graham, and I quite agree in the exclusion, because you then mix up two separate authorities. I cannot myself conceive, either when manœuvring or fighting, why there should be that mixture of two companies under one Officer, who, nominally superior, might be superseded or replaced by a man who is not known to the rest of the two companies, mainly by quitting his own company for the command of the two, if he becomes the senior. The Prussians have considered the necessity for having the Officers mounted. I noticed Colonel Graham at first said, that our companies have not had the general independence that he considers they ought to have; but he afterwards a little corrected himself, when he spoke of what occurred in war, for I suppose in no Service in the world, certainly in no better record of it than in "Napier's History," has there been shown a greater independence of the company, or a more trusting feeling on the part of men to their officers, than in the several actions that we read of in that history. I think we are peculiarly strong when the company Officer has the means of really being with his men in action. They are attached to their Officers, and the company influence is as great as in any Service in the world. I do not know that you would increase that influence by making it so much larger. There are many other observations that might be made on this subject; but I hope that other gentlemen who have experience in the habits and discipline of our regimental system will give us the benefit of their opinions, for it is most valuable that we should know them. I do not know whether Colonel Graham would wish to make any other remarks.

SIR LUMLEY GRAHAM: With regard, Sir William, to what you just said about our Army in the Peninsular War. Of course, we all know how intimate are the relations between the British Officer and the soldier in the field; how well the Officer looks after the soldier, and the soldier looks up to the Officer. But still, I think the independent tactical working of the company has rather grown up in the field than been taught before-hand; that is rather what I alluded to; the English company has succeeded rather in spite of the peace system than in con-

sequence of it; and I mentioned those exceptions that were known to me, in which a company had been prepared in peace for what it had to do in war. With regard to the difficulty of commanding a strong company in action, I think that difficulty perhaps may be more apparent than real; first of all, from the fact that we never have a company anything approaching the nominal strength actually in action. Supposing my proposed establishment provides for 220 fighting privates, if I had 180 of those privates to fight under me, as a Captain, in the first battle I was engaged in, I should think myself very lucky. You will bear me out in saying that would be as large a proportion as I should have a right to expect. That would allow me only 170 privates; that reduces my difficulties very much of command, and I think my difficulties would be reduced even more by the careful training of the subaltern and non-commissioned Officers; that is how, in Prussia, the Captains manage to control their large companies. There is such a thorough understanding by the inferior Officers, that they all know almost by instinct what the Captain wants them to do. I think in that seems to lie the secret of the power of commanding large companies, and that of course can only be attained by constant practice.

The CHAIRMAN: In our Service you must take off one-fourth.

Sir HAMILTON GORDON: I think you will not find the Prussian Officers dismount under fire, but only at the time of attack.

The CHAIRMAN: I do not know the exact rules. I remember the tactical retrospect made in the Prussian Service, in which the great fault then found with the company and company column was, that every one went to the front. You will remember there was a case in which every soldier, non-commissioned Officer, and even the Generals, went to the front, and they all joined the fighting line, and that made an enormous extent of line, scarcely controllable. That, I remember, was the effect of making that fighting line. That I cannot say.

Sir HAMILTON GORDON: Did they all dismount? I have made special inquiries on that subject. It is only at the time of assault that the Officers dismount, and not merely when they come under fire.

The CHAIRMAN: Not in the preparation to do so?

Sir HAMILTON GORDON: No. Is not there some new order from the Horse Guards about mounted Officers dismounting?

Sir LUMLEY GRAHAM: Contained in the memorandum of last week.

The CHAIRMAN: That memorandum is very much in accordance with the Prussian system. If no other gentleman wishes to make any remarks, I am sure that we may thank Sir Lumley Graham for his lecture, which contains points of very great interest, and is a subject which we are all very glad to hear discussed. I only wish there had been more Officers present to give us their opinions.

## LECTURE.

Friday, June 25th, 1875.

Lieut.-General Sir FREDERICK W. HAMILTON, K.C.B., Colonel 21st Royal North British Fusiliers, in the Chair.

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### UPPER BURMAH: ITS DEFENCES AND WARLIKE RESOURCES.

By Captain EDMOND BROWNE, 21st Royal North British Fusiliers.

I SHOULD not have had the boldness, Sir Frederick Hamilton and gentlemen, to address an audience like that which is before me to-day, on this platform from which so many distinguished soldiers and sailors have from time to time given their views and experiences for the improvement of our Army and our Navy, were it not that I had hoped to make up for my want of ability as a lecturer, by surrounding my subject with the interest which generally attaches itself to the narration of *personal observations*, for when I was quartered with my regiment at the little frontier station of Thayetmyo, some three years ago, I obtained leave from the Chief Commissioner of British Burmah, to visit the capital of the King of Burmah, and to pass up the Irrawaddy, as far as Bamò.

I went there with the sole object of examining and reporting upon the defences and warlike resources of the country, with a view that the information thus privately obtained might be of public advantage in case of a future campaign.

In the first place then, gentlemen, I will ask you to turn to the map.

Burmah, you will observe, is bounded on the west and south by the Bay of Bengal, on the east by the Shan States and China, and stretches northward to the mountains of Thibet, occupying, it is estimated, 44,450 square miles. It is intersected by the three rivers, the Irrawaddy, the Sitang, and the Salween.

Ranges of lofty mountains rise between the rivers—the most important, the Arakan hills, intervening between the valley of the Irrawaddy and the sea.

Countless streams, rising in the mountains, flow into the great rivers, swelling their waters, and at every step obstructing the advance of the traveller. These streams are deep, sluggish and muddy near their mouths.

The Irrawaddy rises in the mountains of Thibet, and for the first two hundred miles has a contorted channel and consists principally of

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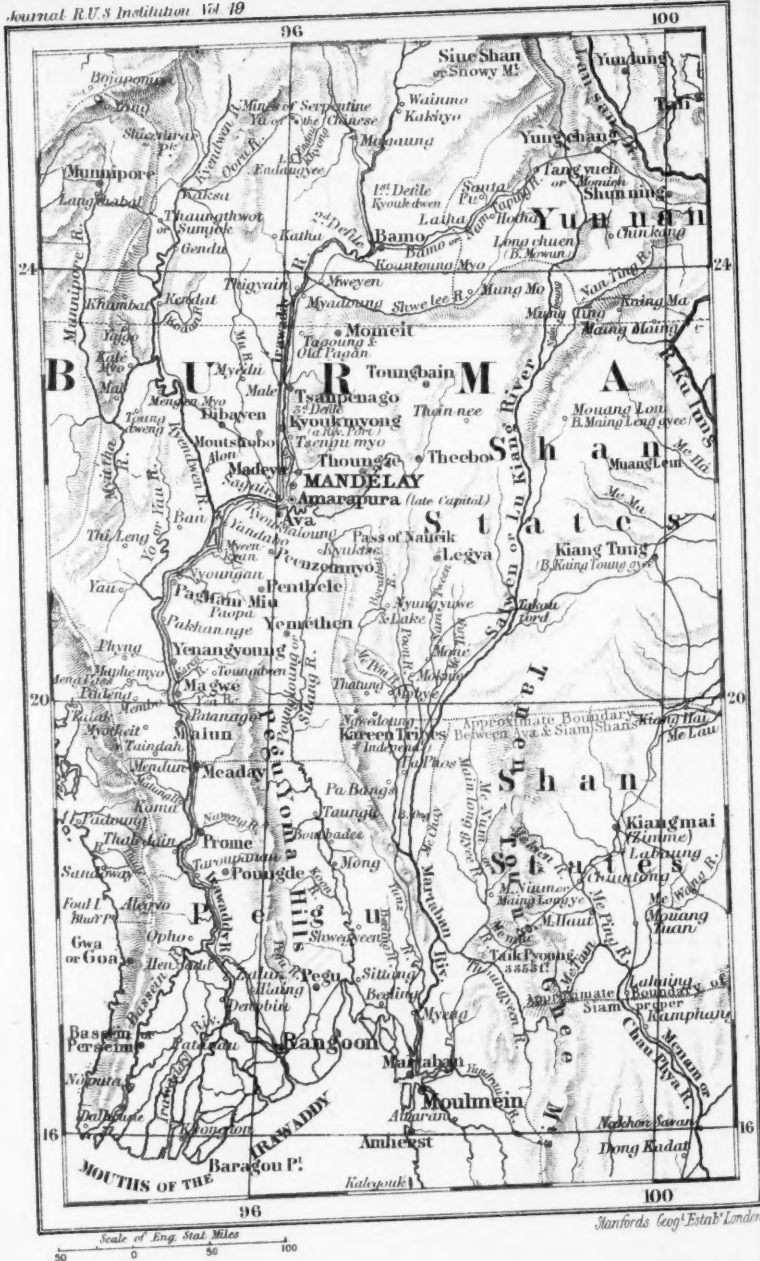
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rapids; as it approaches Bamò, however, it widens out and is navigable for small steamers throughout the remainder of its course. The Irrawaddy falls nearly forty feet in the dry season. The Sitang which appears on the map next on the right of the Irrawaddy, takes its rise in the mountains east of the present capital of Burmah, and pursuing a course almost parallel to the former, enters the sea near the ancient city of Pegu. It is navigable for small steamers as far as Shuygyn, about half way to the British frontier station of Thoonghou. Troops are conveyed up the Sitang in Burmese boats, and the navigation is generally attended with some danger in consequence of the *bore*, a tidal wave, or bank of water which rushing up the river, overturns and swamps all boats with which it comes in contact.

The third great river, the Salween, rises in the mountains of Yunnan, and flows in a south-westerly direction, till in the vicinity of the mouth of the Sitang, it takes a south-easterly course and enters the sea at Maulmein. Navigation is difficult and dangerous throughout.

Large quantities of teak are floated down the Salween from the extensive forests on the north.

Looking at the map of Burmah then, such appear to be its general features. I will next proceed to give you in detail some account of the great Irrawaddy which is the principal artery of the country, and on the banks of which are situated all the principal towns. I will proceed northward from the sea to the city of Bamò, a distance of about 600 miles, up to which point I can speak from personal observation.

The Irrawaddy, as will be seen by the map, enters the sea by numerous mouths, forming a huge delta like that of the Ganges. On one of these branches is situated the rising and prosperous city of Rangoon; a somewhat narrow but deep and navigable creek communicates from Rangoon with the main channel of the great river, which it enters some miles south of the town of Donabeu. From this place to the city of Prome, the river is about two miles in width, abounds in shoals and sand-banks, and requires careful navigation. Some twenty miles further north, the boundary of British territory is reached.

The town and fort of Thayetmyo is the most northerly point occupied by British troops. The river here is about a mile and a half in width at the end of the Monsoon, of which time I write, but much less in the dry weather, and the current is at all times powerful.

Travelling upwards, a lofty range of hills lines the left bank for some fifteen miles, when it takes a westerly direction. The east bank is low and covered with thick jungle. Many villages appear on both banks, but there is no sign of extensive cultivation.

From this point till the town of Mengla is reached the course of the stream, divided into two channels by a large island, is twisting and irregular, the banks lofty and wooded. The Burmese made a stand here in the war of 1826.

Mengla is a town of about 5,000 inhabitants. A few miles north of this town another stand was made by the Burmese, who erected a stockade on the neck of land formed by the Irrawaddy and the Yen, which joins it here.

The next places of importance are Mugway on the left bank and Memboo on the right, both considerable towns; the heights surrounding these places are thickly studded with white pagodas. Memboo is the nearest point to the Aeng Pass, which leads over the Arakan hills into Arakan. Twenty miles further north is another pass which General Morrison attempted unsuccessfully to cross with his army in 1826.

Ye-nan-Jioug, situated in an inlet of the great sandstone cliffs, is celebrated for its petroleum wells.

The character of the country now changes, the thick jungles disappear and the land has a parched and inhospitable appearance. On the left bank is the site of the ancient sacred city of Pagan, a space of seven miles in length and two in breadth, being literally covered with the ruins of temples and pagodas of every conceivable shape and size, in all stages of decay. These ruins point to the fact that this part of the world must have once been the centre of a populous and enterprising district. It was at this place that the Burmese made their last attempt to check Sir Archibald Campbell's force in 1826. The river here is of immense breadth and continues to flow in the same direction till some fifty miles further north, when it bends at right angles, and after a few miles, steering an easterly course, the traveller comes in sight of the ruins of the ancient capital which has given its name to the once famous and powerful kingdom of Ava.

Nothing now remains of the old place but crumbling walls, rotten stockades, and shapeless mounds of earth which once were parapets. It is strongly situated by nature, being surrounded by water on three sides.

Opposite to Ava, embosomed in a thick wood, lie the ruins of Tsagain, another ancient capital.

The Irrawaddy once more alters its course at this point, flowing north and south—and is cut up into several channels by wooded islands.

Amarapoora, the late capital, only discarded by the present King in 1858, appears in an inlet of the river about five miles from Ava. The wall and ditch which formed the defences of the city still remain in fair preservation, but the place has been almost entirely deserted by the Burmese and is chiefly occupied by Chinamen.

Mandalay, some seven miles further north, is the present capital of Burmah, and is situated about two miles from the river's bank at the foot of an isolated hill 600 feet in height and now crowned with several Buddhist temples.

The city is laid out in a perfect square, the sides of which run due north and south, east and west, and are, as near as possible, one mile in length. It is rendered secure against attack in the following manner:—

A solid brick wall about 25 feet in height and 3 feet in thickness surrounds the city. Behind this an earthen parapet about 30 feet thick has been thrown up, which being raised to within about 4 feet of the top, is allowed to slope away towards the interior; no revetment is attempted.

There is little attempt at flanking defence, at intervals of about 150 paces buttresses protruding, while at the angles two of these

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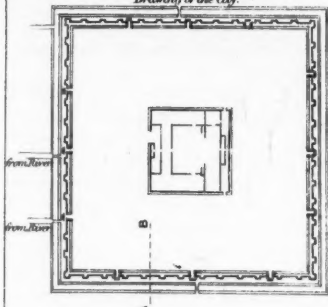
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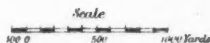
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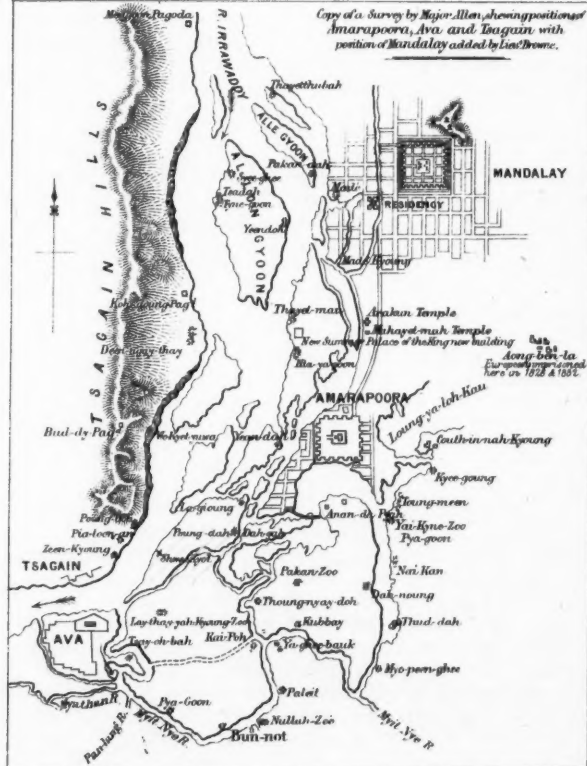
Plan of the City of Mandalay Reduced  
by Lieut. Browne from a Burmese  
Drawing of the City



Section Through A.B.



Copy of a Survey by Major Allen, showing positions of  
Amarapura, Ava, and Tsagayn with  
position of Mandalay added by Lieut. Browne.



Drawn by Lieut. Brown, 1854.

meeting have something the form of a bastion. The wall is not loop-holed or provided with embrasures for guns, the top being crenellated after the fashion of our ancient castles.

Each of the four sides of this wall and rampart is provided with three gateways constructed of masonry of immense thickness and solidity: the gate in the centre of the passage which is about 15 feet in width is of teak wood studded with iron nails; and is about 20 feet in height and one in thickness. All the twelve gateways are similar in construction and are protected on the outside by traverses of solid masonry, so placed as to completely protect the passage.

A moat of about 100 feet in breadth, and 6 or 7 in depth, encircles the city; the escarp of the ditch being cut at about 60 feet from the walls, leaves a fine road between. This moat is kept full of water all the year round, except on the south side, which was not completed when I visited the city. One bridge crosses it, on the south, east, and north sides, each; and on the west, that which faces the great river, two. No precautions have been taken to defend these bridges.

The roads in the interior of the city are wide, but unmacadamized, being much broken up at places. They run in the same direction as the walls, dividing the city into rectangular blocks of houses.

In the centre of the city is the palace of the king, about 350 yards square, and surrounded by a stockade 20 feet in height, and constructed of teak stakes, 9 inches in diameter, firmly bound together by bars of the same wood passing through them horizontally.

The palace is divided into three enclosures, after the manner shown in the plan. There is a brick wall inside the stockade, then an esplanade of considerable width, another brick wall, until the inner enclosure is reached.

There are three entrances to the palace, the main and only public one being situated in the centre of the east side; the two smaller ones are near the eastern ends of the northern and southern faces.

The reception hall of his Majesty is remarkable for its barbaric splendour, walls and pillars being loaded with gold leaf, but dirt and neglect pervades all.

The whole of the arms, ammunition, and valuables of the kingdom are stored within this "Holy of Holies."

I saw everything that was to be seen, except the "noble savage" himself, who excused himself on the plea of illness.

The big guns were numerous, but were in an unserviceable condition, and I was informed that there was no ammunition, but that, in case of war, plenty could be obtained. No trained gunners.

There were a couple of thousand stands of arms—old muskets, rifles, and double-barrelled guns, all mixed up together in the arm-rack. They were all rusty, and shamefully kept.

The place was guarded regularly by sentries, who strolled about or squatted under the verandahs, and appeared too lazy even to be attracted by the brilliant uniform of my companion—a Captain in the Royal Navy.

I should say that the king could not assemble more than 3,000 trained soldiers for the defence of the place, but this number would

be swelled by raw levies raised in the vicinity of the capital and withdrawn from the country.

The inhabitants of Mandalay number 20,000 within the walls, and 60,000 without.

The population is made up of natives of India, Munnipoor, and Chittagong, Shans, Siamese, and Chinese, all of whom intermarry with the Burmese. The Chinese are by far the most thriving and prosperous of this heterogeneous multitude.

The isolated hill which appears on the map on the north-east corner of the city, commands a fine view of the surrounding country. It was certainly the most wonderful I have ever witnessed.

Below is the square city, with its interminable suburbs spread out like a panorama; the Shan mountains to the west, the Tasagain hills to the east, the winding of the mighty river between, with its wooded islands, its numerous quaintly-shaped boats and temple-studded banks is a sight, once seen, not easily to be forgotten.

Opposite the capital, the Tasagain hills look down upon the river at places overhanging the stream, and again recede to a distance of several hundred yards from the water's edge. They contain quantities of valuable marble, and continue to follow the course of the river northward, for a distance of about fifteen miles, when they die away into gentle undulations.

At the foot of these hills lie the remains of the famous Mengoon Pagoda, one of the largest masses of solid masonry in the world. Here, also, is an enormous bell, said to be the largest in the world, after that of Moscow Cathedral. It is 90 tons in weight, or fourteen times as large as the great bell of St. Paul's.

The time allotted for this lecture will not permit me to enter into detail in describing this interesting country.

Proceeding northward, then, we leave on our right the fertile district of Madara, whence much of the fruit and vegetables consumed in the city are obtained.

To the westward, the country is undulating and clothed in dense woods. On the east bank is a small town, Singu-mayo, whence a road leads to the principal ruby mines.

The stream here becomes contracted to from 300 to 400 yards across; the banks are high, and covered with forest.

There is little or no sign of cultivation, even in the vicinity of the villages, while the numerous fishing apparatus that may be seen along both banks denote pretty clearly that the inhabitants trust to the finny tribe for subsistence.

The hills in the neighbourhood are said to contain gold, silver, and precious stones. Extensive mines lie about thirty miles to the eastward.

The lower defile cleared, the stream once more widens out, navigation becoming no easy matter in consequence of the sandbanks and low, sandy islands. The villages are poor and the absence of pagodas marked.

Tagoung and Old Pagan, now poor looking places, were once royal cities. Dr. Williams, who visited them in 1863, found the remains of the fortifications of both.



Above these places the Irrawaddy is joined by two considerable streams, the Shwe-lee and the Delain. The banks continue low and swampy till the mouth of the second defile is reached. Between the northern elbow of the river and the mouth of the defile, is the sacred island of Shwe-goo, held in great veneration by the Burmese, and positively a forest of pagodas.

The scenery throughout the second defile is exceedingly striking; precipitous mountains covered with thick forest tower over head, while below, the great river, confined to a narrow channel, hissing, boiling and forming itself into huge eddies, rushes down with resistless force. At the head of this defile the river again widens, stretching out like a large lake, and on the left bank is the town of Bamò, which brings our travels to an end.

This place, of which there is a sketch in my military report, has no appearance of ever having been a large or thriving city. It is defended by a stockade on the land side.

The confluence of the Taping with the Irrawaddy takes place a couple of miles north of the town. It was from this point that our two exploring expeditions started under Sladen and Browne.

Of the tribes who inhabit these wild regions, by far the most numerous are the Shans.

They are found from the borders of Munnipoor to the heart of Yunnan, and from the valley of Assam to Bangkok and Cambodia.

They are a quiet, dirty, and inoffensive people. The Kakhens inhabit the lofty mountains to the north and north-west. They are said to be a wild and savage people.

The Poloungs dwell in the mountains north east of Bamò.

Most of these tribes, according to Dr. Clement Williams, acknowledge in theory the Burmese suzerainty.

Beyond the Burmese frontier on the east are the Panthays, a tribe of Mahomedan Chinese. They are a brave and enterprising people, and for years maintained their independence against the Chinese, but have lately succumbed.

Throughout the whole of Burmah, from Rangoon to Bamò, there is scarcely a village without its little Chinese portion. Situate generally in the middle of the town, the clean and smart appearance of the Chinese dwelling is remarkable. They monopolise most of the trade of the country, ever working with unflagging industry. They are in reality hostile to Europeans, though not openly so.

I feel sure, Gentlemen, you will agree with me that a lecture of this nature would be incomplete without some account of the history, character, and customs of the people who inhabit this strange and interesting land, particularly as regards their connection with Great Britain in two protracted and bloody campaigns.

The early history of Burmah, in common with that of all Asiatic nations, is, for the most part, obscure, while the veracity of that which does exist is of a questionable nature. Unaccustomed to keep regular records except, perhaps, of some remarkably stirring events chronicled on the bark of trees or cut in stone, and given by nature to monstrous exaggeration, the inhabitants can give little reliable information regard-

ing their country or their people previous to association with western nations. The celebrated traveller, Marco Polo of Venice, whose travels Colonel Yule has lately given to the world, seems to have been the first European who visited these shores, about the year 1272; but it was not until the beginning of the sixteenth century that Europeans attempted to establish trade relations with the Burmese.

At this period the country was divided into many principalities. There were kings of Arakan, Pegu, Thounghou, and Tenasserim. These monarchs generally took it in turn to desolate the neighbouring states, and to slaughter and carry off all on whom they could lay hands.

One Boves, a Jesuit, writing in 1600, speaks of the result of one of these internecine contests in the following language:—"It is a lamentable spectacle to see the banks of the rivers set with infinite fruit-bearing trees, now overwhelmed with the ruins of gilded temples and noble edifices, the ways and fields full of the skulls and bones of wretched Peguans, killed or famished and cast into the river in such numbers that the multitude of the carcases prohibited the way and passage of many ships."

Portuguese adventurers from time to time mixed themselves up in these quarrels; and, in the beginning of the seventeenth century, we hear of one, Philip de Brito, being proclaimed king of Pegu. He was attacked by the king of Ava however, defeated and taken prisoner to the capital, where he was impaled and set up in a conspicuous place.

According to Colonel Yule, to whom I am indebted for this information, "the dominance of Ava over the lesser states commenced from this time." She was everywhere successful in war, and extended her dominions in all directions, conquering Pegu, Tenasserim, and Arakan, and occupying the Shan, city of Zimmé. So important a state had she become that the East India Company, which was formed in 1599, sent agents to several of the large towns on the Irrawaddy. On occasions of royal whim or displeasure, these gentlemen were ignominiously expelled, and occasionally did not succeed in getting off so easily. But at this time the servants of the Honourable Company were a very humble people, their sole object being to accumulate wealth.

In 1695, we hear of Nathaniel Higginson, governor of Fort St. George, addressing a letter to the king of Ava, couched in the following terms:—

"To His Imperial Majesty who blesseth the noble city of Ava with his presence, emperor of emperors, and exceeding the kings of the East and the West in glory and honour, the clear firmament of virtue, the fountain of justice, the protection of wisdom, the lord of charity, the protector of the distressed, the first mover in the sphere of greatness, president in council, victorious in war, who feareth none and is feared by all, centre of the treasures of the earth and of the sea, lord proprietor of gold and silver, rubies, amber, and all precious jewels, favoured by heaven and honoured by men, whose brightness shines through the world as the light of the sun, and whose great name will be preserved in perpetual memory." This was followed by a request to be allowed to carry on trade unmolested, the envoys

being instructed to get as much out of the king as they could in the way of presents, and to "ask for more."

In 1757 the company induced king Alompra, who had turned out the ruling dynasty and usurped the throne of Ava, to sign a treaty ceding to them the Island of Migrains, at the mouth of the Irrawaddy in perpetuity.

But in the following year, the King becoming impatient at their intrigues, ordered the whole of the foreign residents on the island to be murdered, which brutal order was carried into effect on October 5, 1759.

At this time the victories of Clive in India gave the Company a confidence which they had not hitherto possessed; and they deputed an envoy of Ava to demand satisfaction for this outrage. But he found the city in a case of tumult; the king having died there was a fight going on for the vacant throne. Alompra's son succeeded, after a tough struggle, in establishing himself in power.

He was an able statesman and daring warrior, and under him the kingdom of Ava reached the zenith of her power.

In 1794 Captain Symes was deputed to Ava to appeal against Burmese encroachments on our Chittagong frontier. The King refused to admit him into his presence. Then followed several other missions from the Governor-General to his Majesty: some were decently received, while others were ignominiously expelled. In the meantime the attacks on our frontier became more frequent; and, in 1824, the Government of India declared war against the Burmese Empire.

The plan of the campaign was this: A strong defensive force was to be extended along our frontier from Chittagong to the Burrampoota at Goalpara.

That a second army, being assembled at Chittagong, was to proceed down the coast to the attack of Arakan.

That a grand army and fleet should be conveyed to Rangoon, and advance up the Irrawaddy to the gates of Ava.

This was the general idea. We shall see how it was carried out.

*Operations of the First Army.*—It was divided into three divisions, the left at Goalpara about 3,000 strong, the centre at Silhet 3,000, the right at Chittagong 2,000. The left column advanced up the Burrampoota early in March, and invaded Assam; but on the commencement of the rains, in April, it was obliged to retreat with the loss of its commander, Colonel McMorine, who had died of cholera.

In the following October this force again took the field under Colonel Richards, and succeeded in its object, viz., the capture of the city of Rungpoor.

The Silhet column had for its object the capture of Munnipoor. The first attempt failed in consequence of the rains; and the second made in the following October was not more successful. The difficulties of passing men and guns through impenetrable jungles and over deep creeks were insurmountable, and Brigadier Shulldham was obliged to abandon his project and break up his army, which had been increased to 7,000 men.

That General Shulldham's army was unnecessarily large is proved by

the fact that when the advance to Munnipoor was checked, the Raja, who had been aiding us to recover his lost dominions, assembled some 500 raw levies, armed by the British Government, advanced to Munnipoor, captured his ancestral city and drove off the Burmese. In the meantime the Chittagong column had met with a great disaster, the advance party being attacked, driven back, and all the Officers, except two who were wounded, killed. The column retreated on Chittagong, and was only saved by the arrival of reinforcements.

*Operations of the Second Army or Army of Arakan.*—This army consisted of 11,000 men under Brigadier General Morrison. It set out for Arakan early in January, 1828, proceeding partly by sea and partly by land. After a long and wearisome march, the land force having constantly to be transferred to the boats to cross the numerous arms of the sea and creeks, General Morrison succeeded in his object, the capture of Arakan, not, however, till after some hard fighting, and no small loss.

*Operations of the Grand Army or Army of the Irrawaddy.*—This was conveyed to the mouth of the Irrawaddy by a splendid fleet of British ships-of-war in May, 1824.

Sir Archibald Campbell<sup>1</sup> commanded, and the force consisted of 13,000 men with a plentiful supply of artillery. After nearly two years of campaigning, during which time fever and dysentery worked ravages in our ranks, Sir Archibald approached the city of Ava, and the "Lord of the White Elephant" was at last brought to his knees.

On the 24th February, 1826, the Treaty of Yandaboo was signed. By this Treaty, the king agreed to concur in a commercial treaty, to receive a British resident at Ava, to concede in perpetuity the province of Arakan, and to pay a crore of rupees. Until the payment should be made, Rangoon was to remain in the hands of the English.

Thus closed the first Burmese war.

The Burmese fought bravely throughout, considering their want of organization and of good arms.

One would have supposed that after such a lesson, the kingdom of Ava would have felt a little humbled; but the reverse was the case, for scarcely had our troops been withdrawn from the vicinity of the capital; when, as Colonel Yule tersely expresses it, "the arrogance of the nation, with marvellous elasticity, recovered its old exorbitance."

Resident after Resident was treated with scorn and neglect by the King and his ministers, until it was found necessary to withdraw the residency to Rangoon, and six months later from the country.

King Tharawaddy, who ruled at this time, seems to have been a prince of some gallantry.

Colonel Yule writes—"In 1843, when Sir Charles Napier's campaign in Sindh was first heard of at Ava, Tharawaddy remarked "that he was on the best possible terms with the British, and that if "they would send ships to Rangoon he would put 1,000 men on each

<sup>1</sup> The Burmese Army of the Irrawaddy was commanded by the Chief Bundoola, who was in the habit of chaining his gunners to their guns.

"to go and fight on our part in Sindh. I want nothing in return from Queen Victoria, he said, except a small feather or some trifle." "When he made this chivalrous offer," continues the same author, "His Majesty was putting people to death every day by his own hand."

The indignities offered to our representatives and our merchants ever since the conclusion of the first war, might at any time have served as a valid cause for the renewal of hostilities. But the truth is, our hands were full at this time. The disastrous Cabul campaign in 1842, followed by the Sikh war, which, though successful, shook our Eastern Empire to its very foundation, demanded all the men we could muster. But we only wanted time.

In 1851 the Governor-General demanded satisfaction for the repeated insults offered to our merchants. The King took temporary fright and agreed to everything that was proposed.

It was only for a month or two, however, for in January, 1852, on a mission of officers being sent by Commodore Lambert to the Governor of Rangoon, they were insulted by the menials about the Court, and informed that his Excellency was asleep and couldn't see them.

To this insult the Commodore replied by seizing the King's ship, which was lying in the river, and declaring the rivers Rangoon, Bassien, and Salween to be in a state of blockade.

Negotiations ensued. But no arrangement could be come to, the same shifting policy being adopted which had ever marked the proceedings of the Court at Ava. War was declared for a second time against the Burmese Empire.

On the 4th April a force of 6,000 men, with two brigades of artillery, under command of Major-General Godwin, C.B., was conveyed to the mouth of the Irrawaddy.

The operations of this Army may be thus sketched :—

5th April.—Capture of Martaban.

11th April.—Capture of Rangoon.

14th April.—Capture of the Shoe Dagon Pagoda.

2nd June.—Expedition to Pegu.

27th July.—Lord Dalhousie arrives at Rangoon.

1st August.—A general advance decided upon.

The Army divided into two brigades under Brigadier-General Sir J. Cheape and Brigadier-General Steel, C.B.

9th October.—Promé captured by Sir J. Cheape.

10th November.—General Godwin leads a second expedition against Pegu.

14th December.—Third expedition against Pegu.

1st January, 1853.—Proclamation of the Governor-General annexing the Province of Pegu to the British Empire in the East.

It now remained for us to expel by force all the Burmese troops who remained in the Province. This was not a difficult matter. One chief, Myat Toon, alone held out and defied our power. He had established himself in a strong position, about thirty miles inland from Henzadar, and in the end of January Captain Lock, C.B., at the

head of a small force of sailors and marines, attempted to dislodge him. This expedition was bravely but unwisely led. They lost themselves in the dense jungle, were surrounded, and their leader, Captain Lock, and most of his officers were killed. The remainder had to make a disastrous retreat through a dense forest, intersected by numerous creeks, followed and harassed by the enemy.

A month later Sir John Cheape advanced with a force of 700 men to dislodge Myat Toon. His expedition was an utter failure, and he had to return to the great river without being able to reach the robber chief.

But Sir John, a hero of Moultan and Goojerat, was not to be so easily baffled in his object. He organised another force, and early in March set out from Donabew. The difficulties he encountered were almost insurmountable. After an eight hours' march on one occasion the advance party found themselves on the identical spot from which they had started the same morning. But the British leader was determined not to retire, and his resolution was at last rewarded by success. After several days' hard marching, with cholera raging in his camp, he arrived in front of the enemy's position—a long low breastwork on the opposite side of a deep ravine. The thickness of the forest prevented the steady formation of the troops, while the enemy commenced to pound them with every description of missile—rough iron and leaden balls, pieces of glass, necks of bottles, great lumps of granite, and even brass representations of their heathen gods, ejected from rusty old cannon jinjals (guns throwing two ounce bullets), and hollowed out palmyra trees bound round with iron. But British courage was once more triumphant. Storming parties, consisting of the 18th Royal Irish and 80th Regiments, were formed, and clambering over the stockades, drove out the Burmese at the point of the bayonet. These storming parties were led by Lieutenant Taylor and Ensign Garnet Wolseley respectively. Both were severely wounded, the former dying a few days later; but the latter has lived to take part in many more fierce and bloody contests, and to be an honour and an ornament to the British Army.

This may be said to have been the last episode of any importance in the war. A land column under General Steel had penetrated the country from Martaban to Tounghou. They met with no opposition, the place being reached after a thirty days' march.

Thus ended the second Burmese war, but no formal treaty of peace was signed.

Lord Dalhousie once more arrived in Burmah and fixed the position of the two white pillars which mark the boundary of British territory on the banks of the great river.

#### *Remarks on the Campaign.*

It will be seen from the above narrative that the Burmese trust entirely to their improvised fortifications for defence; and that even the consciousness of the possession of a vast superiority in numbers will not induce them to quit these rough defences for the open.



Living in a country covered with forest they are highly skilled in woodcraft, and the rapidity with which they can erect stockades and form impenetrable entanglements in the jungle is astounding.

As to the methods of attacking them in their strongholds, the experience of this and the first war teaches us that assault was by far the most effective; but in these days of improved artillery they could certainly be "routed out" without having to resort to such an expensive mode of attack.

Notwithstanding that the campaign lasted nearly a year, the opposition offered to our arms was not at any time formidable, and there is little doubt that had we advanced straight on the capital early in August, the war would have been quickly brought to a close.

Individually the Burmese are not cowards, and if well led are good soldiers. They are much given to panic, however, which is attributable to the utter incapacity of their chiefs.

In hardihood and power of undergoing hunger and fatigue, they are certainly equal to any people under the sun. The "field kit" of a Burmese soldier consists of a mat to sleep on, carried at the end of his musket, a cooking pot slung over the other, round his loins is found his wallet of rice, which added to the *dah*, or chopper, inseparable from every Burman, completes his outfit for a campaign. When such luxuries are not obtainable, however, these sturdy little fellows can keep themselves alive and in working condition for months on leaves, herbs, and the bark of certain trees.

Throughout this whole war, the untrustworthiness of the Burmese guides seems to be apparent, and points to the necessity of the utmost caution in the event of a future campaign in Burmah.

In the summer of 1855, Major Phayre, the Commissioner of Pegu, was deputed to Amarapoora, now the capital of Burmah proper, to negotiate a commercial treaty.

He was accompanied by a suitable escort of European troops, and was well received by the King. The story of this mission has been ably told by Colonel Henry Yule, and is both instructive and amusing.

Neither trouble nor expense had been spared to display to advantage the power and wealth of the kingdom. Every available citizen and country bumpkin had been rigged up in a grotesque dress and converted into "a warrior bold," while the valuables, in the possession of which the Burmese prided themselves, were everywhere displayed under the noses of the visitors.

After considerable delay, His Majesty fixed a day for his grand reception, and the party adhering cheerfully to the absurd formalities of the court, removed their shoes and squatted half kneeling, half sitting at the foot of the throne.

The King made a few general remarks about the Crimean war and the topics of the day, and then dismissed the English officers. Several other receptions were given after this, but the King talked of every subject but that of the treaty; on the necessity of the strict observance of the ten virtues—charity, religious observances, self-denial, learning, diligence, patience, truth, perseverance, friendship, impar-



tiality, but on the subject of the treaty he was dumb. "The two great powers were on friendly terms," he said, "and what was the use of a treaty."

Major Phayre urged the necessity of some written agreement, but in vain; and at length wearied and disgusted, he returned to Rangoon with the object of the mission unfulfilled.

For the next two years no important events occurred; while British Burmah thrived under the vigorous administration of Colonel Phayre.

In 1858 the King moved the seat of Government from Amarapoora to Mandalay, the present capital. At the end of 1867, Colonel Phayre was succeeded by Colonel Fytche, who at once turned his attention to the long-sought for commercial treaty. His courage and firmness were rewarded and the treaty signed.

Colonel Fytche next despatched Captain Sladen, the political agent at Mandalay, to explore the trade route through Burmah to Western China.

The expedition started from Bamò with the avowed good will of the Burmese Government, the objective point being Talifoo, the capital of Yunan. They were thwarted at every step, however, and eventually obliged to return, having only reached Momien, half way to Talifoo. There is little room for doubt that the Burmese authorities at Bamò had secret instructions to use every means in their power to defeat the object of this expedition. This was the opinion of Captain Sladen and his party.

I have now brought you down to our own time. The expedition to this same country under the leadership of Colonel Horace Browne, its disastrous failure, the murder of Mr. Margary, and the retreat of the party surrounded and pursued by enemies, was but the other day a common topic of conversation, and is not cleared up yet. With this I close the historical portion of my lecture, and will now make a few remarks on the Burmese system of Government, military organisation, &c., &c.

The monarch has absolute power of life or death; and can confiscate property without trial or investigation—a privilege of which he invariably avails himself if he has reason to believe that any of his subjects are becoming too rich.

The affairs of the State are principally conducted by a council of four Woonghis, or Ministers of State. These constitute what is called the Hlwot Dan, or High Court and Council of the Monarchy. Next in importance to the above gentlemen are the Atwen Woons, or Ministers of the Interior, whose duty it is to look to the private wants of His Majesty and to convey his orders to the Supreme Council.

For the sake of local government and collection of revenues, the country is divided into myos or districts. Over each district is placed a governor or Myo-oke, who appoints his own subordinates over towns and villages. The revenue is obtained from several sources. The house or family tax, each district being taxed according to the number of houses it contains. From this tax there are many exemptions, such as being in the Government service, &c.

Agriculture is taxed according to its value, and is almost invariably paid in kind; there is no regular tariff, however, the amount varying in different districts, and depending often on the wealth of the payer. Rice, pepper, onions, tobacco, palmyra trees, yielding juice for sugar, salt, and other articles for daily consumption, together with bullocks for ploughing, and sometimes fisheries are taxed.

In 1855 the revenue of the kingdom amounted to £400,000, and is probably about that amount to-day. There is no such thing as progress with the Burmese. "What is, is good" is their motto.

The army is raised and organised for war rigidly on the local system. Each district has to furnish a contingent strong in proportion to its inhabitants. Each corps of 500 men is commanded by a Boghi, or commandant, who has under him captains of hundreds and captains of fifties. Little attempt is made to train these forces during peace, the officers being entirely ignorant of their duties.

Districts are held responsible for the supply and arming of their own contingents, but the system of doing so varies in different districts. The governors of districts obtain their soldiers by conscription, and substitutes are allowed on the payment of money. The subordinate officers are paid by having a certain portion of rice and money levied on the people allotted for their subsistence. The commandant pays himself by levying a tax on his own officers and men.

From the above description then, it will appear that the strength of the Burmese Army must depend on the population, and its efficiency on the amount of arms and ammunition in the country.

Considering the area of the kingdom the population is wonderfully small, amounting to only 3,000,000 souls. The arms now in possession are few and of a wretched description. The British Government does not allow the King to import arms.

The naval resources of the kingdom may be estimated at *nil*.

Education to a small extent is universal among the Burmese, every child being taught to read and write by the Phoonghis or Buddhist priests who swarm in every town in the country.

They subsist by voluntary contributions, and are known by their yellow garments.

In religion the Burmese, in common with all the Indo-Chinese nations, are Buddhists.

They do not believe in the existence of a God in the sense of our faith, but in reward and punishment in an infinite succession of existences varying in duration from the span of insect or animal life to incalculable periods. In this faith live 369,000,000 of souls.

The character of the Burmese has been sketched with photographic truth by Major Allen in the following words—

"Unlike the generality of Asiatics, the Burmese are not a fawning race. They are cheerful and singularly alive to the ridiculous, buoyant, elastic, soon recovering from domestic or personal disaster. With little feeling of patriotism, they are still attached to their homes, greatly so to their families.

"Free from prejudices of caste or creed they readily fraternise with strangers, and at all times frankly yield to the superiority of the

"Europeans. Though ignorant, they are, where no mental exertion is required, inquisitive, and, to a certain extent, eager for information; indifferent to shedding blood on the part of their rulers, yet not indifferently cruel. Temperate, abstemious, and hardy, but idle with neither fixedness of purpose nor perseverance.

"Discipline or any continued employment becomes irksome to them, yet they are not devoid of a certain degree of enterprise.

"Great dabblers in small mercantile ventures, they are (the women especially) a race of hucksters, not treacherous or habitual perverters of the truth, yet credulous and given to monstrous exaggeration; where vested with authority, arrogant and boastful; if unchecked, corrupt, oppressive, and arbitrary, not distinguished for bravery, while their chiefs are notorious for cowardice, for with the latter cunning in war ranks before courage. Inexpert in the use, and careless in the preservation of their arms, they are indifferent shots, and, though living in a country covered with forest, are not bold followers of field sports."

I cannot bring this lecture to a close without making a few suggestions and proposals on our best mode of procedure, should the present negotiations at Mandalay terminate in a third Burmese war.

In the event of this, I conceive that the "theatre of war" would be almost exclusively confined to the valley of the Irrawaddy from our frontier to the Burmese capital; for on this portion of the Great River are situated the richest and most important towns in the kingdom, while inland the country is thinly populated, is covered for the most part with thick jungle, and intersected by a network of rivers and creeks.

The object of operations ought certainly to be the occupation and destruction of the capital.

Its fall would completely paralyse the kingdom and reduce further resistance to a minimum, for within its walls are almost all the stores and valuables of the king; and, furthermore, his only truly loyal subjects are the Burmese who reside in Mandalay and its vicinity.

The frontier of British Burmah is, at present, defended by the fortresses of Thayetmyo on the Irrawaddy, and Thongon on the Sitang.

Each is garrisoned by a wing of an European regiment and one native infantry regiment and a battery of field artillery. Since the annexation of Pegu, in 1852, no communication has existed between these two posts, but a road is now under construction, and is so far finished that, some few months ago, Colonel Jebb, 67th Regiment, marched a detachment from Thayetmyo to Thongon in nine days, no man suffering.

Elephants are necessary, the road not being practicable for carts.

It takes five days by steamer to reach Thayetmyo from Rangoon, and seventeen days at least to reach Thongon by country boats from the same city. The distance between the posts is about 120 miles.

Troops are conveyed up the Irrawaddy on flats towed by small

steamers. Each flat will accommodate about 250 soldiers or a battery of field artillery. In case of war, conveyance for a force of 5,000 would be obtainable.

In the dry weather—November till April—troops can be marched from Rangoon to Thounghou by land. There is also a practicable road from Rangoon to Prome which is only some 25 miles from our frontier. I think that a force having for its object the conquest of Upper Burmah should be formed into two corps; one the army of the Irrawaddy, the other the army of the Sitang. The first-named corps should consist of about 5,000 men with a plentiful supply of light guns, and should proceed up the river on flats and river steamers early in August when the navigation is easiest, to the direct attack of the capital. A few of the most important towns might be shelled, but it would not be necessary to waste time in their capture or occupation.

The land column or "Army of the Sitang" might be similarly composed, and march with the same object in view, later in the year after the capital had been occupied by the first army. They would require to be well provided with materials for crossing the numerous creeks by which the pathway—for on Burmese authority one does exist—from Thounghou to Mandalay is interrupted.

And now, Gentlemen, I believe I have exhausted my subject. I have traced on the map the geographical features of this interesting country. I have given you my own personal experiences and observations. I have related in a compendious form the history of Burmah from ancient to modern times, touching somewhat hurriedly on our later relations with the Burmese King—his duplicity, his cunning, his utter disregard of truth or honesty; and I will leave you to speculate for yourselves on the probabilities of his having thwarted the two attempts made by the Government of India to open up a trade with Western China.

Notwithstanding his many shortcomings, however, the King of Burmah has a perfect right to govern his country independently of Great Britain; but it is the duty of the latter, as mistress of civilization in the East, to demand, and, if necessary, enforce his co-operation in great schemes for the furtherance of trade, of progress, and of enlightenment.

## LECTURE.

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Friday, July 2nd, 1875,

Admiral SIR HENRY J. CODRINGTON, K.C.B., in the Chair.

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### SEAMEN OF THE FLEET, THEIR TRAINING, AND HOW THE EMPLOYMENT OF MARINES AFLOAT IN PEACE TIME AFFECTS THEM.

By Captain J. C. WILSON, R.N.

BEFORE entering fully on the subject of this paper, it may be well to remind my hearers that prior to the Russian war all the seamen of the Fleet were entered only for a ship's commission, their term of service ending when the ship paid off. In consequence of the difficulty found in manning our ships at the beginning of and during the war, Government in 1854 determined on introducing what is now termed the "continuous service" system, by which men are engaged to serve for ten years from entry, or from the age of 18.

To provide men it was also found necessary to train boys, as merchant ships had, in a great measure, ceased to carry apprentices, and the supply from that source could no longer be relied on. The growth of the training service has been gradual, and it is only during the last five or six years that the Navy has been entirely dependent on it to make good the annual deficiency of men in the Fleet.

Our seamen, therefore, are no longer birds of passage, migrating from the Royal to the Merchant Navy, sometimes serving under the English, at others under the American Flag, but a carefully picked and expensively reared body of men, a standing force, which must be kept up to a certain numerical standard, regulated, not by the immediate requirements of the Navy, but by the policy of the country. It is consequently obvious that with the establishment of such a permanent force, the conditions of service became totally changed; and, to meet such an altered state of affairs, other radical changes were, and still are, necessary to make the whole system work harmoniously and efficiently. To begin with the boys; there are five stationary training ships under commanders, with an "Inspecting

Captain," who has the general supervision of the whole. In these vessels three thousand youths are supposed to be trained annually, but as the supply has never yet equalled the demand, the number has hitherto been from two to three hundred short of the vote. The boys, if their parents consent, are taken at from 15 to 16½ years of age, after having undergone a most stringent physical examination. These requirements being satisfied, if they can read, write, and cypher fairly, and have never been committed by a magistrate, they are allowed to engage for ten years from the age of 18. On completing one year's training, and, after passing an examination, they are rated "1st class boys," when a certain proportion are put through an advanced course of gunnery, either in the "Boscawen," or in the gunnery ships, and about one-half of them are also sent on a six weeks' cruise in one of the five training brigs. A rôster is kept on board the "Inspecting Captain's" ship; and, as far as circumstances will admit, they are drafted in rotation by him. Taking one with another, boys are two years from entry until rated as men, or, in other words, their average age on entry is 16; and, taken throughout, they have about two months' sea service in the fleet as boys. Though our sea going ships carry as many boys as they can stow, there are still from 1,500 to 1,700 constantly on depôt, waiting their turn for draft. This delay is much to be regretted, and can only be avoided by keeping sufficient training ships at sea to provide for that proportion of boys (about 1,400) which are due to the men kept in our home ports. Whilst thus waiting, a considerable number of them reach their 18th year, and are by order rated men, thus the 1,200 ordinary second-class, may be taken to represent a body of sailors, who have never been at sea at all!

As to the quality of the boys, I found but little difference between those drawn from town or country, both have their advantages, but there is no doubt that the younger they are taken the better sailors they make; and, what is more, though they may be more costly at first, they are, on the whole, the least expensive, as they become more identified with the profession, and consequently less likely to desert.

The training of boys has been encouraged by successive Boards of Admiralty, but by none more so than the late board whilst presided over by Mr. Goschen. Under his auspices, and the able administration of Sir W. Tarleton and of his predecessor, Captain (now Admiral) Wiles, many very important improvements were introduced, such as provision for a proper outfit for the lads before being sent to the Fleet, a liberal scale of dietary, suitable to healthy growing boys, with a regular system of drafting them in turn. Under the present Government, they have been granted the still greater boon of a free kit on entry, value 5*l.*, which enables them now to remit home a large portion of their pay from the very first.

Taking the average of the three years from 1871-1874 (and all the figures I shall quote apply to this period) I find the seamen in the fleet, or what are called in Parliament, "*pure blue jackets*," numbered 18,683; of these 18,050 were C. S. men. The number is made up as follows, P.O., 3,942, L.S., 1162, A.B., 7,153, ordinaries 5,206, and

ordinary 2nd class, 1,210. The waste on these varies from 11·5, to 14·0 p. c. per annum, and on the above, amounted to 2,504, excluding re-entries.

To replace the waste 2,727 men were rated from boys, or entered, 2,400 from boys trained in the training ships, 204 from first class boys (or novices), raised and instructed in the coast guard ships, and 123 men entered probably as second class ordinaries in the coast guard, or receiving ships. The lads entered as first class boys in coast guard ships are, in my opinion, very inferior to the others, they are usually but little under eighteen when entered, and speaking from personal observation, I would say are generally older than they represent themselves to be, and if so, of inferior *physique*.

The bulk of the waste arises from three causes, first, death and invaliding; secondly, discharges; thirdly, desertion.

The first is unavoidable, the second includes men pensioned (328), those sent to coast guard (221), and 175 ten-years' men, third, deserters numbering no less than 709. With such a drain on the service from desertion (which for 1873-74 was 835, and I have good reason to believe is nearer 1,000 for 1874-75 than 800), it is a matter of importance that its cause should be ascertained, and some means devised of stopping, or at any rate checking it. The loss of seven or eight hundred men per annum, at first sight, appears but a small affair, but when it is remembered that each of these deserters has had regularly to be manufactured from the raw material into a seaman, and that on an average each one of them has cost the country from three to four hundred pounds, it will be seen what an enormous expense desertion entails, probably not less than from £200,000 to £300,000 per annum.

Nor does the mischief end there, desertion is the principal reason why our seamen, as a body, are so dangerously young, and so wanting in experience; the deserters absorb for no useful purpose, a large proportion of our instructing power, and render it next to impossible for the boys, and young seamen, to obtain the sea-service necessary to fit them for higher rates, and their work. The cause of desertion lies probably more in the nature of the man, than in the profession; restless, high spirited, and healthy, with no experience of the world, he pines for change, and does not discover until too late that labour out of the service has quite as many drawbacks as in it. To meet the case, I would introduce a more elastic system, combined with time pay, by which a man could, with reasonable facility, obtain his discharge from the Commander-in-Chief of the station, or under certain circumstances, from his own Captain.

Every five years I would increase each man's pay by 2*d.* a day (£3 a year) whatever his rating might be, so long as it was not below that of A.B. To do this some £60,000 a year would be added to the Estimates, but if it only reduced desertion by one-half, the country would be largely the gainer, not only in a pecuniary sense, but also in the increased efficiency of the service. At first a considerable number of men might be expected to apply for their discharges, but after a time, many would return to their old calling, and settle down steadily



to their work. If a man really wishes to go he can always manage to do so, the *punishment* for desertion only prevents him *returning*, not leaving. Considering how young we engage our boys, and the time we bind them to the service, it is no less just than expedient, to allow them an opportunity of gaining their freedom on fair terms, and with reasonable facility.

Much has been said and written about the loss of "ten years" men, but the fact is, our loss numerically is small, being probably not more than from 18 to 20 per cent. of those who annually complete their first period of service, or about 175 in all. Still 175 "ten years" men, small as the number looks, represents the equivalent of one year's entry of boys in, say, the "Ganges," for, as for every three boys enrolled we have only one man at the end of ten years, allowing for waste, the loss of 175 ten years' men necessitates the entry of about 525 boys. These men, few in number, but admirable in quality, are now totally lost to the service, but if allowed to take as a retainer, the time pay proposed above, and not required too frequently to requalify, they would no doubt be glad to enroll themselves as a reserve, always available, and composed of the very best material.

The crews of men of war are made up of two classes of men, viz., combatants, and non-combatants, the former consist of seamen, and marines, and their officers, the latter, of civilian officers, stokers, artificers, cooks and stewards, &c. The proportion of non-combatants is, in ships of the following type.—

" Sultan " .. ..	30 per cent.
" Devastation " .. ..	50 "
" Hotspur " .. ..	58 "

In vessels corresponding to these, of some years back, the proportion was, in the—

" Royal Albert " .. ..	10 per cent.
" Immortalité " .. ..	20 "
" Zebra " .. ..	30 "

It is, therefore, clear that the tendency is for the fighting element to decrease in the newer vessels. This, in my opinion, is a most dangerous fact, for though a ship thus manned may be efficient for fleet purposes, it must render her less so for the numerous other contingencies certain to arise in time of war, and such a preponderance of undrilled, and very imperfectly disciplined men, is at all times, but especially in an emergency, a cause of weakness which may lead to failure, if not disaster. Without barracks, where such men, like the sappers and miners, could be regularly disciplined and trained, I fear this sad blot on our naval system must remain.

The combatants consist of seamen and marines, but I will at first confine myself to the former. It will be seen from figures I have already given, that we have but 12,000 able bodied men, which is surely as low a number as the most rigid economist would dare to advocate for the "first naval power of Europe." I contend that they, and they alone, are the proper class to estimate the *seamen* power of our fleet by; the custom of speaking of our men as "pure

blue jackets" in Parliament, is misleading, for all naval men know how any one, from a cab-driver to a crossing-sweeper, may be included under that designation, whereas for a man to be rated an A.B., he must be a sailor of some experience, and knowledge of his profession. However good and useful ordinary seamen may be, they are at best but learners, and should, therefore, always be as much distinguished from the finished sailor, as boys are from them.

I will now proceed to analyse the services of our seamen. The fleet consists of sea-going, and harbour ships, which may be roughly divided as follows:—

Regular men-of-war from sloops to ironclads. .	72
Small class gunboats, yachts, tugs, brigs, and surveying vessels .. .. .	82
Turret ships .. .. .	1
Troop and store ships .. .. .	16
Stationary and coast-guard ships .. .. .	49

In sea-going vessels we have only 10,500 blue jackets of man's rate, the remaining 8,000, are in the harbour ships. Such being the ordinary state of the service, it follows, that our men cannot have more than eleven and a-half years at sea, such as it is, out of their twenty. Dividing the twenty years into four periods of five each, I find the standing of our men to be, 10,000 of under five years' service, with an average of eighteen months at sea and twenty and a-half years of age; 4,270 of between five and ten years' service, with an average of four and a-half years' at sea; 2,603 of from ten to fifteen years' service, and seven and a-half years' at sea; and 1,816 of between fifteen and twenty years' service, and ten and a-half years' at sea. This calculation is based on the supposition that each man has exactly the same amount of sea service, which is practically not the case. A curious fact will be observed from the above figures, viz., that our P.O.'s<sup>1</sup> and L.S. combined, exceed in number the whole of the men in their second period (of ten years') service, and that the P.O.'s alone, are, as nearly as possible, one-third of our able-bodied men. Such being the case, is it surprising that many of the P.O.'s are inexperienced and of doubtful character.

During the time men are in reserve at the home ports, they have no systematic instruction, either in drills, or seamanship; indeed masts and sails are not even provided, boating also is entirely neglected, nor is there room in the receiving ships, even had they the staff, to instruct men properly. With naval barracks, all this loss of valuable time would be avoided, men could be examined on their return from sea, and rubbed up where found deficient. If at first it was thought too expensive to attach to such establishments rigged vessels to exercise in, the men could still have gymnastic instruction, which, by developing

<sup>1</sup> A.B. stands for Able-bodied.

P.O.	"	Petty officer.
L.S.	"	Leading seaman.
T.M.	"	Trained man, or men.

their muscular powers, would, at any rate, fit them in some measure for the work they have to perform at sea.

However well our seamen may be instructed in gunnery in the regular men-of-war, and in the gunnery establishments, the system elsewhere prevailing at home, is, in this respect, most imperfect, neither room, staff, or other essentials being provided, consequently drills are carried on in a very slipshod manner, doing the men more harm than good, as slack drill, where attention is not enforced, is extremely detrimental, and does more to "un-discipline" men than anything else which could be well devised. Here again the want of barracks is sadly felt, in them the seamen could be qualified properly in all their drills in half the time, and much more thoroughly, than when afloat, and with that exactitude which is so very essential to perfection, and which is the backbone of *real* discipline.

At present there is no guarantee, that after all the care, trouble, and expense now bestowed in training our men, they will have a weapon in their hands, or pass a day's drill, from the time they leave the training ships, until they are pensioned out of the service, for it is quite possible that a man may spend the whole of his time in troop, store, or receiving ships, and at the end of his career be as ignorant of his drills as a ploughboy.

Of the 18,683 men now in the fleet, 3,230 are seaman gunners, and 6,462 T.M., leaving 8,889 not classed as either. Considering that they all belong to a standing navy, mainly reared from boys, this is, I submit, hardly satisfactory, especially to those who know how imperfect most of the men noted as T.M. are in many of their drills.

Were the men systematically qualified during the time they are in reserve, our standing force of seamen, however deficient they might be as *sailors*, could at any rate be relied on in time of war as trained fighting men to leaven the scratch crews with whom they are sure to be mixed, and be able to fill the more important duties at the guns; but if not better instructed than at present, they will be found far too imperfect themselves to help others, though sufficiently so to form, as it were, the "dunnage," to fill in round better men in our peace establishment.

Keeping as we do a very limited number of ships in commission, and seeing how little sea work we are at present able to give our seamen, it becomes a matter of the first importance to consider whether, in *peace time*, marines should be embarked in *sea-going vessels*.

I at once grant, that if the country is prepared to keep enough ships going to employ our seamen and marines, it would be best for both classes of men to be embarked, so that they might be accustomed to work together in peace, as they would have to do in war. But as we well know, this is not done, and never will be done, it is simply a question whether the seaman, or the marine, deteriorates most by remaining in reserve. It is sometimes argued, that if the marines are not embarked in time of peace, they will become nothing more or less than soldiers, and that regiments of infantry would be as useful at sea in time of war; this I deny. In the first

place, a marine enlists to serve afloat, as well as on shore, but besides, his training is very different to, and much more elaborate, than that of a mere soldier, as in addition to learning a soldier's duties, he is taught ship gun drill, how to swim, pull a boat, work in rope, and other valuable matters, which fit him for his position on board from the moment he steps over the gangway. Indeed, a marine may be said to receive no instruction on board ship, beyond what is necessary to enable him to work efficiently with the other men at his gun; his training in fact is completed on shore, and he is requalified in all his drills, each time he disembarks. Thus, a marine loses nothing of his proficiency as a *fighting man* by remaining in barracks, and it is a question whether the experience he gains of ship life by sleeping in a hammock, and the art of keeping himself awake for a four hours' watch, when sentry in a stuffy cockpit, is of equal value to what he loses in other ways. In our sea-going squadrons we have at present in round numbers 4,000 marines, who, if landed, would make room for nearly one-half of our young seamen, now rusting in harbour ships without any adequate professional instruction, either in seamanship or gunnery. Surely, when there is not room for all, the *sailor* should have the preference, he must, under the most favourable conditions, deteriorate more than the marine, and we know that proper provision is made to instruct the one, at such times, and not the other. In peace time, the marines should garrison our principal naval ports, under the command of their own general officers; such appears to be their birthright, and would probably be so regarded in any other country but England. Detachments, in proportion to the size of the squadrons, might be kept at the naval head-quarters of each station, under field Officers, ready to march on board at the first sound of war, displacing a like number of seamen, who again, with more marines, could man any reserve ships kept on the stations, or be sent home for disposal. Thus the marines would become the *expanding medium* of our Navy, and be embarked only when from the introduction of naval reserve men, and other half-raw material; their presence would be the most valuable, adding, as it would, solidity and discipline to the crews, and rendering the ships more thoroughly efficient as fighting ships.

The word discipline is only partly understood in the Navy, and is often mis-used; *good conduct* is too often mistaken for real discipline, such I take it, is but one feature of its meaning, for men may be very indifferent characters, and still be kept under admirable discipline. Thus we sometimes hear the marines compared unfavourably with the blue-jackets, if the former happen to commit more faults than the latter, and the discipline of the seamen consequently extolled; but the fact is, that by training from boyhood, the seamen class has improved in *respectability*, and from being early removed from contaminating influences, their average *character* is better, and possibly now superior in some ships to that of the marines; but I deny, I own with regret, but still emphatically, that the discipline of our seamen is superior, or even equal, to that of the marines; nor can it ever be so until we have barracks for them on shore. True discipline can only be

arrived at by attention to innumerable small details, and by a punctual, and exact routine, which afloat, the exigencies of ship life do not allow of. It should be a branch of a young Officer's instruction how to deal with men, so as to render them willingly amenable to discipline. Education now-a-days makes it daily more necessary that they should be treated with proper consideration, and thoughtfulness; the grades of society run so much one into another, that it is difficult to draw the line between classes; and I know, from personal experience, that it is now not uncommon to find as blue blood under the seaman's serge frock as under the Officer's uniform coat.

I have herein briefly sketched out the present position of our seamen, in the hope that a question so vital and interesting may be freely discussed. I have ventured to advance opinions in which I know many of my brother Officers will not agree, but the arguments brought forward against them will, whether convincing or not, at any rate be instructive. It must not be supposed, because I have pointed out some of our shortcomings, that I do not recognize the vast improvement which has of late years taken place amongst our seamen; they are undoubtedly superior as men of warships to a like number taken from the Fleet twenty years ago; but, considering that we rear them from boyhood, they still fall far short of the standard we have a right to expect, and are inferior in discipline and training to the French, if not the Russians. The fault does not lie with the Officers, but in the organization which is extremely defective, and must be entirely altered before the results can be satisfactory. With England's resources the material of the Navy can never be so difficult to provide as the trained seamen. The smaller the number, the more reason is there why these men should be as perfect as possible, so that in war they may be *potent* enough to leaven the mass of half, or wholly untrained material, with which they must be mixed.

All countries are looking to their navies: France, even now, after all her misfortunes, employs 22,000 *seamen* in her Fleet, with a reserve of 80,000, not including 20,600 marines. Russia has 20,000 *seamen* in her Fleet, with 40,000 in reserve; and even Germany, a power which, twenty years ago, could not man a small frigate, has 4,370 *seamen* and 300 boys afloat. These facts speak for themselves. We must not forget the lesson taught us by the late American War, how in a few months the *personnel* of their Navy was expanded from 5,000 to 60,000. If our trade is not to be driven to seek shelter under neutral flags, we must be prepared with ships to cover the ocean, each vessel of the enemy's will require six of ours to watch her, such vessels must have a large proportion of seamen in them, and unless their crews are good they will find themselves at a disadvantage, for no enemy's cruiser will be sent out against our trade, without a large, and thoroughly efficient ship's company. "Once let us forfeit our naval supremacy, and we could not retain, even for a few years, our mercantile and maritime pre-eminence. Therefore that policy is most advisable which secures our power of striking hard at an enemy in war, even if it expose us to some annoyances, not exactly of a flea-bite character, in time of peace."

<sup>1</sup> From *Standard* of March 22, 1875.

Since writing the foregoing paper, my attention has been called to an interesting article in the "United States Naval Institute Journal," on the Manning of their Navy and Mercantile Marine, by Captain S. B. Luce, U.S.N., and from which I will quote the following paragraphs:—

"The breaking out of the Crimean War revealed two interesting facts, till then not generally known: the splendid organization and discipline of the French Navy, and the low state of the English seamen. Following promptly the opening of hostilities, the French squadron put to sea in the highest state of efficiency, and large bodies of troops and all the various munitions of war were transported to their destination with an alacrity and order which filled with dismay their ever-watchful neighbours across the channel, while numbers of the finest line-of-battle ships of the English Fleet swung to their anchors, in helpless inactivity, waiting for men. The English, relying on their ancient prestige, had been content to continue customs which the advanced state of naval science had long before rendered ineffective; while the complete reorganization of the French Navy, commenced by De Joinville, and wisely continued by the late Emperor, brought the French Fleet up to the state of perfection in which the war found it."

Again—

"Money can always be raised by the State, and money will produce any number of craft; but money will not make sailors; gold will not make a disciplined crew nor an experienced staff of Officers; and of what use are ships without the living soul to command and the ready hand to obey? To collect, form, and train these should be the first solicitude of a great maritime power, as it is the most important part of its tasks."

These opinions, coming as they do from a talented and observant Officer of the U.S. Navy, corroborate what I have attempted less clearly to express, and show, however highly some of us may esteem our own seamen, that others, equally well able to judge and who are more disinterested, consider them, at any rate, inferior to the French in organization and training as men-of-war's men.

The CHAIRMAN: Captain Wilson having concluded his interesting paper, I hope some gentlemen present will give us the benefit of their opinions on the subject.

REAR-ADMIRAL WILLES, C.B.: I beg to thank Captain Wilson very much for his interesting and carefully drawn up paper. Even if it does no other good, it starts a discussion on a very important question. As I am limited to ten minutes, I cannot waste time even in paying compliments to the gallant lecturer. All I can say is, that bearing in mind that he is one of the Officers who, we hope, will be to the fore, when some of us are passed away, we cannot attach too much importance to the opinions he has expressed. Two months ago I listened for three days to an important discussion in this theatre upon recruiting the Army, when our gallant Chairman's brother was in the chair; and all I hope is, that we shall be a little less condemnatory in our opinions than the Officers of the sister Service were upon that occasion. The state of the *personnel* of the Navy, in the event of a great war, is this. The total vote of men, including Coast Guard, is 60,000, of which, Captain Wilson very truly said, the "pure blue jackets" are but 18,000. The Pensioners<sup>1</sup>

<sup>1</sup> By Parliamentary Return, July, 1875, there are 9,692 long service pensioners,



6,000 to 7,000 able men, and the Naval Reserve 17,000; but what number we should obtain when that force is first called out, is a question that might lead to discussion. I will take it at about 12,000. That gives us 75,000 men at the first outbreak of war. Looking at an old return, I find that in the year 1812, when America was our enemy as well as France, the vote of seamen and boys was 113,000, marines 31,000, making a total of 145,000. At the present time we have just half that number. In those days three or four months elapsed, and sometimes longer, from the rising of the cloud until the storm actually burst. I think, in 1870, war was declared after five days; therefore, it is certain we shall not have much time to prepare. Now how are we going to increase our force from 75,000 to 145,000 men, assuming ourselves to be at war with two maritime Powers? That is a question I hoped Captain Wilson would have started, for it is a very important one. I maintain that we have not the Mercantile Marine to fall back upon as in former days. As far as mere figures go, perhaps, we have; but the material that we want does not exist. Every movement of late years that has tended to the grandeur of England has gone against the Mercantile Marine. The abolition of the Navigation Laws, and doing away with apprentices, are two such measures. No doubt, England has prospered very much in consequence, but the sailor has deteriorated. The Suez Canal has been damaging. It has swept away the sailing traffic round the Cape of Good Hope, and the steamers themselves are chiefly manned by Lascars. This question becomes a very serious one; and as I see some of our rising Officers here, I say they must look it in the face; we must have a system by which the men may pass from the Navy into the Merchant Service, and *vice versa*. Sir Frederick Grey, four or five years ago, wrote a pamphlet on the subject,<sup>1</sup> very well worth reading. Mr. Childers was also alive to this; and I sat on a Committee which was very much criticised at the time, where the deliberations pointed in the same direction, *i.e.*, the amalgamation of the Mercantile Marine with the Navy; so that, when war broke out, we could at once put our hands on a large body of trained men. Our report was considered by the Admiralty a confidential document, and therefore I cannot say anything about it. I mention this to show that the subject was not overlooked by Mr. Childers and his successor. No doubt the present system of supplying the Navy is very nearly perfect; it was perfect until the large ships were reduced and the ironclads and smaller ships became more common. The state of the case now is as Captain Wilson has said, we positively have not got enough ships to train our boys. I am sure Captain Wilson would not have quoted figures that are not correct, and therefore I repeat boldly his statement. We have 1,500 first class boys for whom we have no ships, so that we cannot keep up our full complement of 18,000 *seamen*. We must have more ships—not ironclads, not small sloops, but training frigates. Mr. Goschen determined to commence that system, and the “Aurora” was fitted out. Prejudice, I fear, did away with her, and we never got another. Mr. Goschen intended to have two such ships; they would have taken about 600 or 800 ordinary seamen or boys; very disagreeable work for the Captains and Officers, but what are we for but in peace time to train men so as to be ready in case of war.

I will now just venture to criticise one or two points of Captain Wilson's paper. First, he proposes to give facility for discharging men. Well, I do not like that, it is so difficult to get others, they are too valuable. And what is a sailor? I remember some years ago, when Sir Charles Wood was First Lord of the Admiralty, continuous service men were allowed to take their discharge; it was *practically discharging them*, because a sailor is a restless creature, and gladly accepts any change proposed to him, and so we lost a lot of valuable trained men, never to return. I think we should be very careful how we let our men go, and particularly troublesome

of which 4,063 under 50 years of age, 5,629 over 50 years of age. A very large proportion of the 9,692 would be available in case of war; the elderly men in fitting out ships, and replacing young men now employed on that duty.

<sup>1</sup> Sir F. Grey, in 1870, proposed to establish, with State aid, training ships for boys at our principal mercantile ports; the boys to be rated ordinary seamen at 18, serve one year on a ship of war, then pass into the Naval Reserve for a fixed period, thus increasing that force with efficient *trained* seamen.



characters. I know some of my brother Officers will hardly agree with me, and I think they too frequently apply to the Admiralty to get men discharged. In this way we lose a number who have been trained up from boys and have cost a great deal of money, and who thus obtain for nothing that which a good man has to purchase.<sup>1</sup> I have found it to be a good thing to allow seamen to *change* their ships when they are not going on satisfactorily.

Captain Wilson proposes to increase the able seaman's pay. I think he is quite right. I suggested it some time ago, and I would do it in this way: I would abolish leading seamen; we do not want them. Leading seamen were introduced for this reason: there were very often men in the Navy who were unfit for petty officers—old fellows who went about the deck and made themselves very useful, but still who had not life and activity enough for petty officers—and so the Admiralty of that day established the class of leading seamen, giving them twopence a day extra. A leading seaman is now a stepping stone to a petty officer. That was never intended; therefore I would abolish the leading seaman altogether, and give the A.B.s the twopence a day increase.

I now come to the ten years' men. Captain Wilson has done good service in drawing attention to that subject. Captains are under the impression that our ten years' men are leaving us; it is not correct. They go, but to another ship. We lose a very small proportion; but even that small proportion is a very great loss, and I suggest that the 6*d.* per diem pension, which is only in abeyance, should be given them as retainers. There is another point which Captain Wilson mentions, with which I do not agree. He rather looks down upon the ordinary seamen. I have found too many A.B.s an objection. You would have too *good* a crew if you *have* all A.B.s. It would create jealousy and ill-will about promotion. The Admiralty proportion is a wholesome one: one-third A.B.s, one-third first class ordinary, and one-third second class. That is, I think, a very satisfactory proportion. The young man of 19 or 20 is a very useful sort of seaman.

As to the proposition about barracks. In considering that point, I want to know where the money is to come from? It is quite certain that you will not get the money now. To erect suitable barracks at Portsmouth and Plymouth would not cost less than 200,000*l.* or 300,000*l.*, and they could not be erected under two or three years. The remedy I suggest for the moment is this: I would utilise our gunnery ships more than we do. When the gunnery ships were established we had not a standing Navy, and the idea was that they should instruct a certain number of men to be captains of guns. We now have a standing Navy, and the "Excellent" still exists in the same form. Now my idea is this: Instead of a large frigate having sixty seamen gunners and instructors, I would at once reduce them 30 per cent., and every man in the Navy should pass through a short course of instruction in the "Excellent." When he comes home from sea, let him be sent to the "Excellent" for three months, and then after that rubbing up, let him go to the *dépôt* ship. We should then find that a very small number of seamen gunners would be quite sufficient. The Officers of the "Excellent" and the "Cambridge" must remember that these ships have been made for the Navy. It may perhaps rather upset their present system, but it is for the good of the Service. It was arranged that boys, after passing through the training ships, should go to the gunnery ships, and there pass through a course of training when quite young. I am almost ashamed to say I have been told that they were not looked after, and the system was given up. Captain Wilson actually suggests that the marines shall not be marines. For if a marine does not go to sea, he is not a marine. The marine is a soldier, who passes half his service afloat and half on shore, and by that means, when war breaks out, we get men who are efficient at sea, and in ships like the "*Devastation*;" we only require in addition a few seamen to steer the ship, heave the lead, &c. I heard a Colonel of the Guards say in this very theatre a few months ago, that he could not get recruits for the Guards, because they would enter the Marines; and he said, "Why do they go into the Marines?" Because, in the Marines, they go to sea for three years, and return home with a pocketful of money, and they go down into their country village and swagger away.

<sup>1</sup> Well-behaved men can purchase their discharges.

So if you do not send the Marines to sea, you would not get that class of men. On *other grounds* I regret my friend holds that opinion; but I am very glad he does not belong to that very dangerous class of Officers who are actually proposing to abolish the Marines altogether. I say, give up nothing. If you give up the Marines, you could not increase your seamen by an equal number; for I have proved that you cannot even train your 18,000 seamen. I do think the time has come when we should no longer have marines and marine artillery. I do not see that you want the two corps. Then as to Captain Wilson's remarks about the young Officers. There is nothing so important as that. The day has gone by when our Officers can address the men in violent and abusive terms. You must command the men by example; and I think in addition to teaching this to our young Officers, it would be well if we all exercised the duty of forbearance. We must all show an example to the men. We must remember that the men on the lower deck can now read the instructions just as well as the Officers, and they are all well aware when Officers transgress them. I think these points should be attended to: and if the First Lord of the Admiralty were here, I should say you cannot be too careful in selecting Officers for command; and when there is a doubt as to an Officer's character, give the Service the benefit.

Sir FREDERICK NICOLSON: I should like to ask Admiral Willes, if I understood him rightly, when he said that, in the olden days, say 1810 or 1812, we required 145,000 men?

Admiral WILLES: Seamen and marines.

Sir FREDERICK NICOLSON: I suppose you hardly mean that we have now such a number of ships ready to be commissioned, that we should want anything like that number of seamen. If you take the seamen actually afloat, if you take the petty officers and pensioners annually in reserve, and your Coast Guard, the total number of men would be about 75,000. Though perhaps we might have ships, and have to employ a large number over that 75,000, still I believe we should want nothing like 145,000. Admiral Willes seemed to hint at getting men from the mercantile marine; but you will hardly want the large number that were required in old days, when we had something like 100 sail of line-of-battle ships. I am afraid Naval Officers are not quite unanimous on all points. There is one point alluded to by Admiral Willes with which I entirely disagree, and that is with regard to the discharge of objectionable characters. I believe nothing has so good an effect as that, when a man has once passed through the delicate ordeal which has now ceased to be, but which has been very delicately alluded to, he should, very soon after that, if he commits himself again, be discharged. I know nothing that has a worse effect upon any ship's company than to find that there are three or four incorrigible blackguards in the ship whom the Captain cannot get rid of. I have had a great many instances myself of that, and have seen how difficult it is to get rid of these men. Once I was innocent enough to take up a deserter, who had left me six months before at Hong Kong, feeling confident enough that the Admiral would afterwards discharge him, but I was saddled with him for the rest of the ship's commission. I think greater power should be given to Captains, and certainly to Commanders-in-Chief, to get rid of bad characters, for, in that case, the higher will be the character of men in the Service, and the more the men will come to you.

Admiral WILLES: Sir Frederick Nicolson is quite right. We have actually more men than we could find ships for on the first burst of war; but I have pointed out the probability of maritime war with two nations, and I am quite certain that if such a war lasted for a considerable time, we should require as many men as we did in the last great war.

Mr. STIRLING LACON: Admiral Willes has stated that this is a serious subject, and I believe it to be so; so serious, that when this paper of Captain Wilson's was put into my hands, I made out a few notes, which I will read, in order that I may occupy the time of the meeting as short a time as possible, and also that you may believe that what I put before you is properly considered. The paper is too short, but it perhaps has its advantages; it gives time for discussion, and enables us to go beyond its actual scope: and the great merit of this Institution is, that all subjects are permitted to be freely ventilated in this theatre. It has been stated by a dis-

tinguished Officer in this theatre during this session, that the strength of the Navy was 60,000, and now we find that an equally distinguished Officer, evidently one who knows, states (and I quote his words) "that it will be seen from figures that "I have already given, that we have but 12,000 able-bodied men, which is surely "as low a number as the most rigid economist would dare to advocate for the first "Naval Power in Europe." And again he says, "In sea-going vessels we have only "10,500 blue jackets of man's rate, the remaining 8,000 are in the harbour ships." When the navigation laws were repealed, and the apprenticeship system abolished, it was foreseen by the Navy what must sooner or later come to pass, namely, the gradual extinction of our sailors, and they set to work to bring up their own boys, for the boy is father to the man. I do not wish to enter into or to criticise this branch of the question; for magnificent as I believe to be the present *personnel* of the Navy, I would simply ask, does the country get the utmost that can be given for the money it spends? Boys for the Navy are brought up at a cost of 60*l.* per boy per annum, whereas boys are brought up and fitted for the sea service in the training ships at a cost of 19*l.* per boy; and I have the authority of Sir Rodney Mundy for saying, that the boys brought up for the Navy are too good, and that he would rather have a practical seaman before the mast than one that can work a double altitude. But my object in rising is to direct attention to the Reserve, of which no mention has been made in this paper, and what we have to fall back upon in the event of war. The extract given from the United States' Naval Institute Journal is sufficiently startling, and it is a justification for my entering into this branch of the subject. In former days the Merchant Service was looked upon as the nursery for our seamen, and in the great Continental war, Nelson asked for 120,000 men. Parliament, a few years ago, voted 30,000 men as the reserve of the Navy. Notwithstanding 6*l.* a-year retaining money, and 4*l.* a-year training money, and a prospective pension, it has been stated by Sir Walter Tarleton, within the last four years, in this Institution, that the numbers have annually been dwindling, and he did not think, in the event of war, 6,000 would be forthcoming. It is a most serious thing for the country, the present demoralisation and the apparent gradual annihilation of our merchant sailors, seeing, as Captain Luce says—and I now quote from Captain Wilson's paper—"Money can always be raised by the "State, and money will produce any number of craft, but money will not make "sailors: gold will not make a disciplined crew nor an experienced staff of Officers; "and of what use are ships without the living soul to command and the ready "hand to obey." Our peace Navy should be the nucleus which, in time of war, might be supplied with strength from the Merchant Service, for whose benefit—that is, the protection of our commerce—the Navy, in a great measure, exists. What could the Peninsular and Oriental Steam Navigation Company, in the event of war, contribute by way of *personnel* to the defence of the country? I have it on the authority of the Marine Secretary to the Board of Trade, who has just returned from Egypt and the Suez Canal, that these ships are exclusively manned by Lascars and Chinamen, not one Englishman on board except the Officers.

"England, mistress of the sea,

"With ironclads manned by a heathen Chinee!"

And what support are you, the Navy, likely to derive from your old nursery of seamen? On board ship you have a string of feathers as a vane to show which way the wind blows, and you may take these facts with the same object. During the present session a return has been laid before Parliament (Sir Selwyn-Ibbetson) of 2,600 sailors who have been sent to prison for periods varying from three to six months, with hard labour, for refusing to go to sea at the risk of their lives. Now what becomes of these men, and others, who do not wait for such tender treatment? I have authority for saying, that they are to be found in the coal mines and workshops of England; to such uses has England put her natural defenders. "But," you will say, "you must overstate, you must exaggerate; for although there is an outcry against the scarcity of men, ships must, and do, go to sea as before." They do, minus the 480 unseaworthy ships which have been stopped and condemned under the Act of 1873. Then how are ships manned? I will tell you, and I shall speak from authority. In one of the north-eastern ports the crimps have a large

shed for the manufacture of sailors. They get dock labourers—any refuse of the population—who, a few years ago, would not have been admitted on board any ship. These they equip in a sailor's jacket, and taken into the shed where there is a cart-wheel, by means of which they are taught to steer; and in the centre of the shed there is a cow's horn on a pedestal, round which they march, in order that if any questions are asked, they may say they have been round "The Horn." "But," I asked, "how are they taught to heave the lead?" That, my informant answered me, was too antiquated a thing altogether. I told all this to Mr. Plimsoll. "Well," he said, "I know how the crimps manufacture firemen at Liverpool. They also have a shed, and they put two casks together end to end, with the bottom and head of each knocked out, and when the recruit can shoot a full shovelful of coal or rubbish through both, he is qualified for a fireman, but they do not guarantee them against sea-sickness." The story of the "Cospatrick" will not be forgotten; and we have evidence since then of two ships where the crew had burrowed down through the coals below the fore-castle, had broken through the bulkhead, and with naked lights had plundered the cargo. When remonstrated with by the captain, they refused to give up their plunder, and broke out into a state of mutiny, so that he was obliged to put firearms into the hands of the passengers; and, in another case, the captain, shortly after leaving the land, in a gale of wind, discovered that he had a crew, not one of whom was a sailor, and he went below and took a dose of laudanum. Such is the stuff upon which England may have to lean in the event of war. You may bless your men-of-war, and your gunpowder, and your shot and shell, and your dynamite, and you may write over old England's front door "*Cave canem*," but ships and guns won't fight without gallant English hearts to man them.

MR. SHAW LEEFVRE, M.P.: As Admiral Willels has frequently referred to me in the course of his remarks, and appeared to regard me as that rigid economist, so much deprecated in these quarters, I will ask permission to say a few words, and first to join in giving my thanks to Captain Wilson for the very interesting lecture he has given us. No man in the Service is better qualified for the task. I came here fully expecting to hear something that was very interesting, and I have not been disappointed. I think Admiral Willels, and, to some extent, Captain Wilson also, have overrated the difficulties of the Navy in the event of war. I think neither of them have quite appreciated the very great change that has taken place of late years in the complements of our ships and the proportion of blue jackets required to other men. I recollect some time ago making a comparison of the number of blue jackets in proportion to other men in ships of war of present day and past times. In the old three-decker, such as the "Victoria," 600 blue jackets were required out of a crew of 1,100; while in the "Sultan" only 230 blue jackets are required; and in the "Devastation," less than 100. We have 18,000 blue jackets, of whom 12,000 are on sea-going vessels, leaving 6,000 disposable in our ports; and we have, in addition, 4,200 Coast Guard men, all in the prime of life, the best men we could have found anywhere. Besides that, we have 6,500 pensioners, of whom about 4,000 would be quite suitable to be put on board ship in the event of war, and in addition to these we have the Naval Reserve men. I have also made this calculation: What number of blue jackets would be required to man all the ironclads that we have in reserve, or in the Coast Guard Reserve, and all the coast defence vessels, in fact, every vessel we could possibly send to sea within a reasonable time from the outbreak of war? I believe I shall not be wrong if I put the number at less than 6,000 men; 6,000 pure seamen would be all that would be required to send to sea every vessel that could by possibility be utilized at the outset of war. I say we have a greater number than that at the present moment disposable in our ports. I do not see, therefore, that we are in any danger of falling short in the number of blue jackets at the outbreak of war. Captain Wilson has referred to the number of seamen in the French Navy; he stated that they have 22,000 seamen; but he must recollect that they have no marines in the French Service. The marine corps to which he referred is a corps specially trained for colonial service, and is not intended to be sent on board ship.

Admiral Willels: Always in flag ships.

MR. SHAW LEEFVRE: They are not intended for sea service; and those who have

seen a French regiment on a transport, I venture to say, will come to the opinion that, without special training on board ship, these men would be fitted for very little work at all. They are not marines in our sense of the term. Therefore, when you compare the 22,000 with our 18,000, you must take into consideration the 13,000 or 14,000 marines that we have.

Captain Wilson also referred to the number of men France has in reserve, and stated it at 80,000; but that includes every fisherman, every seaman, and every man in the remotest way connected with the sea, including ferrymen and bathing-machine men. The *ascription maritime* is so rigid that every man whose connection with the sea may be called a sea service is brought into it, and I confess my strong impression is, that on the outbreak of war, the French could count upon a very small number of these men. Captain Wilson has referred to some remarks made by Captain Luce, of the American Navy, with regard to the Crimean War, and he says they are fraught with warning to us. I confess, my recollection does not show that we have to learn any very great lessons from the French. Though they were able to man their fleet on the first outbreak of the war, that fleet was mainly engaged in transport service. They did not even send a fleet to the Baltic, and their fleet in the Black Sea, instead of being as ours, always ready for action, was performing the duties of transport. You must look to the thing as a whole, and though the French service may be well organized, and they may be able to send a great number of men on board at the outbreak of war, they have not the available resources to fall back upon that we have. I think Captain Wilson has referred to the fact, that during the American War, the American Navy was increased from a few thousand men to 60,000 men in a few months. I ask whether that would not be the case here? What reason is there for supposing the American Navy could be increased in that way and ours could not? I believe our resources, as compared with America, are enormously greater, and that though something may be said about the deterioration of the mercantile marine of late years, due to the substitution of steam for sailing vessels, yet, I think even that is exaggerated, and I am confident we have in our mercantile marine a very large reserve to fall back upon. Besides that, we have the enormous fishing population of this country, who, in the event of war, and when time is given, could be trained and made very well fitted for service. To revert to the special questions brought before, I think we must start with the fact, that 18,000 blue jackets is the force which the country considers requisite and necessary for the naval service. That number has been agreed to by successive Governments, and I think on the whole, Parliament and the country is of opinion that that number is sufficient. It will not sanction an increase. All that we can hope for, is that that number shall consist of as good men as possible, and I am quite certain the most rigid economist will hold that view equally with the best naval man, he would wish that what men we have should be of the very best quality possible, and for my part, I would spare no money for that object.

Captain Wilson has pointed out, that to fill up these 18,000 men, no less than 3,000 boys are requisite. In other words, the waste of the Navy in the 18,000 men is such, that for every six men you want one boy brought into the Service every year. That to me is a very startling fact, one which I have often had to consider, and on which I have often spoken to naval officers with great concern. Why is it there is such waste in the Navy? Captain Wilson has pointed out that in part it is due to desertion. He has stated that the average number of deserters for some years past has been 700, that the year before last it was 800, and last year it was 1,000. That seems to me to be a very large number, and I think it is worthy the consideration of naval officers and of all interested in the Navy, whether something could not be done to put a stop to that enormous number of deserters. I confess, for my own part, I think it is in great measure due to the pay. I do not agree with Captain Wilson that it is due to the other causes to which he refers; I believe it is mainly due to the question of pay, and it is a very serious question when you come to look at it, that the pay of our seaman in the Navy is very considerably below that of the pay of the merchant service. We take our boys and train them to a point, when, in every respect, they are confessedly better than the men in the merchant service, and we expect them to remain in the Service at a less

rate of pay than they can get in the merchant service. It is true that the pension is very good, and if you add the present value of their pension to the pay, it may be that their pay is about equal to that of the merchant service, yet seamen are not in the habit of looking so much to their future pension, at all events, during the first ten years of their service. It may be afterwards, during the next ten years, when the pension comes somewhat closer, it then enters closer into their calculation, but I very much doubt whether, during the first ten years, the pension operates so much as some people think. Present pay is that which operates on the seaman's mind. Therefore, for my part, I have always been ready to face the question of the pay of the seamen of the fleet. Of course it is a very delicate question to talk about. I should be sorry to proclaim it on the house-top, lest it should give rise to agitation in some quarters, which would not be pleasant, still, I think it is a serious question whether we should not force the question of an increase of pay for the seamen. If you could prevent the desertion, it would not be necessary to train so many boys, and the expense of training boys is a very serious one. That brings me to another point, whether it is desirable the whole of our seamen should be entered as boys in training ships. I confess, for my part, though thinking we ought to rely mainly for our seamen upon those boys, yet it would be desirable to enter a certain number of men direct from the merchant service every year. And here there is another point which interferes very greatly with this, and that is the difference of pay to the continuous service men and the non-continuous service men. The non-continuous service pay is very much less than the continuous service, and those men are not entitled to a pension unless they serve 21 years. I cannot understand how it can be expected that men should come from the merchant service into the Navy at a lower rate of pay than they are getting in the former; therefore I think that is a question which is deserving of the most serious consideration, whether we should not equalize the pay of continuous and non-continuous service men.

Captain Wilson also adverted, in a very able manner, to the question of the training of the men in our home ports, and I confess that is a point to which very serious consideration ought to be given. It has always seemed to me we have had too many disposable men in our home ports, who are practically doing nothing. Captain Wilson has suggested that these should be sent on board ship in lieu of marines, but that has been pointed out by Admiral Willes as wishing the abolition of the marines as a sea force. I do not agree that that is a practicable solution, but I do think it is feasible that the seamen in our ports should receive a better training. Why should not all the men who are now doing nothing in the receiving ships, go through a course very much like that given in the "Excellent?" and for my part, I think it would be wise to have naval barracks. You must house men somewhere. My experience is, looking from the point of view of an economist, that nothing is more expensive than a floating house. I believe it would be a wise thing to do away with many of these old floating houses in our home ports, and house the men in permanent barracks on shore; and at the same time, if better training could be given to the men during that interval, it would be an extremely wise course to take. A good deal of desertion is due to the men having nothing to do, and at all events, looking at the very great expense which we go to in training, educating, and bringing up these boys, I do not see why we should not make every one of them equal to the average men that we turn out from the "Excellent" and "Cambridge."

In conclusion, I must again thank Captain Wilson for his interesting and suggestive paper.

Captain FITZROY, R.N.: So many allusions that have been made by the gallant Admiral who first spoke with reference to young Captains, that I think I am quite justified in making a few remarks. I will endeavour as much as possible to confine myself to the point of the lecture which I consider a very important one, and one deserving the gravest consideration by the authorities, that at the present moment there are in the home force a number of ordinary seamen that there is no sufficient accommodation for to enable them to keep up their drills properly that they have learned in the training ships when boys, and that there are not sufficient ships to take them to sea, and to enable them to learn their duty as seamen. And the first



remark I would make is with reference to the free kit and allotting. Now that the Admiralty have given a £5 free kit to each boy who enters the Service, and have also permitted them to allot, I have no doubt the Midland Counties and Wales will send numbers of boys to the training ships. We must remember, in dealing with the blue-jackets, we are dealing with the sea-faring section of the labouring class; and that parents in sending a boy to sea lose one of the bread winners. Formerly they did not realise the fact that they would get any money by sending a boy to sea till they got their allotments as ordinary seamen; but now, having their allotment at once, they will very soon begin to see that a boy at sea can assist in the general support of the family.

The most important point is the waste in the Service from discharges and desertion. Something has been said about ten years' men not re-entering. I think many ten years' men would re-enter if they were allowed to have a certain time on leave on full pay, and then returned to a ship in a home port. Desertion is due to several causes; and when we consider what the lecturer has stated that the enormous sum of between £200,000 and £300,000 is lost to the country in a year by desertion, it behoves everyone to think very seriously how it can be met. This £200,000 or £300,000 represents three small corvettes, two large ones or one second class iron-clad, which represents three, two or one Captain on full pay instead of half; or, to bring it more home to the British taxpayer, it represents two or three times as much as the wages of the Coast Guard Service voted this year, which was £93,000. That is very serious. Amongst other causes there is of course the old one of dislike. There is a new one which is, and the higher you educate the boys the more it will come forward, and that is they find they have not sufficient scope for their abilities. Another one is debt; another one is domestic causes. What I want to speak about particularly is the cause of debt. A boy after he leaves the training ship is rated as an ordinary seamen. If he is a good boy he is put at once into the first class, and put upon special leave. He becomes a "pure blue-jacket;" and being on special leave can go on shore three or four times a-week. If they are away from their own home, how do they find means for all this? Why, the answer is, they must run into debt. The first thing they do is to borrow money on shore; then they go to the lower-deck bankers. In all ships there are a certain set of men—for leave has become so generally established and so well understood—who hardly ever put their feet out of the ship except when close to their own homes. They go to the pay-table regularly every month and take their wages; and those wages are lent out at interest and usury to these young seamen who want to go on shore.

There is another set of men who allot and remit their money to people in the home ports, who lend it in the same way at great usury to any ordinary seamen. This goes on for a long time; and, if a lad is not very steady, he runs probably greatly into debt. He finds he has no hope of ever paying, and makes a clean bolt. I am sure that is a very prevalent source of desertion in the Service now. To meet that, there is nothing like increase of pay. I do not think our seamen are half well enough paid, considering that they hold their lives in their hands perpetually. I also agree with what Captain Wilson says about permitting young ordinary seamen to buy their discharge. A discontented man on the lower deck is no use. He may just as well go in peace time. I very often had lads come before me begging and praying for their discharge, saying they quite misunderstood the Service; and when it has been refused they have remained in the ship sulky, and doing harm on the lower deck.

We should also hold out more inducement to petty officers. At present I do not think half enough inducement is held out to induce petty officers to qualify and bring themselves forward for warrants. It is a difficult matter to deal with, because there are so many claimants. I would, therefore, suggest the establishment of a fourth class of warrants—men who would clearly be at the top of the list of first class gunners, boatswains, and carpenters<sup>1</sup>, men whom really we should be very much better without in seagoing ships. I have great respect for them, but, at the same time, I would sooner have a third class boatswain than a first class. At present it

<sup>1</sup> This fourth class should be all the senior men for duty in ships in home ports and in second reserve.



is a most difficult thing to get a petty officer, however deserving, a warrant until his turn comes. I know in the first ship in which I went to sea the Captain of the foretop was only 19 years old, and the Captain of the maintop 21. They were both first class petty officers, and the Captain of the foretop at 21 was a boatswain, and one of the smartest I have ever been shipmate with. The lecturer has remarked on the increase of non-combatants. That is due chiefly to the enormous number of stokers that our ships are obliged to have. As you increase the horse-power, so you must increase the number of stokers; but I think it is quite a mistake to say that they are non-combatant. They play a most important part; and, at present, we have not a sufficient number of them, for after steaming two or three hours at full speed, we are obliged to send down deck hands to help. Our magazines also require many more men to work now than in former days. The powder has to go greater distances, except in a few ships, and all these non-combatants are employed as magazine men or shell-room men all over the ship.

As to naval barracks, I think it is only a question of time. As the rotten old hulks in our harbours where seamen are accommodated are worn out, it will become a question what is to take their place. There is not an ironclad in the Service that has accommodation for over 600 working blue-jackets; therefore the question will be, what is to take their place. The "pure blue-jacket" will either be houseless, or they must build barracks on shore; and I think it would be a wise and far-seeing policy on the part of the House of Commons, if they were to vote certain funds every year towards the erection of those barracks, instead of waiting until the time comes, when they must absolutely be built, and they have to provide a lump sum all at once. I do not agree with removing the marines. If it is necessary to have marines at all they ought to have sea-legs, and to get accustomed to the lower deck. If they are to be done away with, it will be when our barracks have been established for two or three years, and then I think they will die out of their own accord, as no longer required for the purposes they were originally raised for.

With regard to the strength of foreign navies, if we substituted the term sailor for seamen, it would meet the case better. There are a great many sailors in all foreign navies, but not very many seamen. It does not do to depreciate one's probable opponent, but that is the fact as far as I have seen.

One remark has been made with reference to the discipline of seamen and marines with which I am sorry I cannot agree. In many ships you may have the bad luck to fit out with a bad lot of marines and a good lot of seamen, and *vice versa*. But taking the average of the last ten years since the continuous service has been in working order, I must think the seamen are, if anything, certainly superior at sea in discipline to the marines. For six weeks in the spring of last year I was at Plymouth, and during the whole of that time I only saw one blue-jacket badly dressed or drunk in the streets, and that man belonged to my own ship; but I saw several men with red coats on, drunk and disorderly. That is, of course, a question on shore, but I mention it to show how much better their conduct on shore is now to what it used to be some years ago. I attribute that mainly to the admirable system of training, and the very good results of the training establishment over which my gallant friend so ably and zealously presided for three years.

Lieutenant GRAHAM BOWER, R.N.: Captain Wilson has so well put the case that I have very few remarks to offer. There is one subject on which I wish to speak. It seems to be assumed that our ironclads cannot carry more men than they have on board at present, and that we are unable to train the men we actually have at sea. In the last ship to which I belonged (the "Pallas") we had not sufficient men on board to man the guns. Their place was taken when we left England by a hundred supernumerary boys. On arriving in the Mediterranean, this 100 was reduced to 50. But the mischief of the thing did not end here; the boys were very young and were not able to do men's work at the guns. But besides this, we had not sufficient rifles or arms on board to arm the men, that is to say, our arms were supplied for our complement and not for the supernumeraries. The result was, when the boys fell in they were unarmed except with boarding pikes and such weapons as would be almost contemptible.

Another point is the abolition of the marines. I believe many of the younger

Officers in the Service would wish to see the marines done away with, but we should be anxious to know what is coming to take their place: It must be a great waste to employ a seaman whose service of training has been a very expensive one in the ordinary deck-duty which could be equally well performed by an able-bodied landsman with a very slight sea training: If we establish naval barracks and enlist landsmen with the seaman's dress, and under the authority of the Captain and naval Officers, then perhaps many of us would wish to see the marines done away with. Landsmen enlisted under the authority of the Captain would, no doubt, perform the duties of the marine as well as at present, and it would do away with the anomalous system of having two Captains in the same ship. The marine's dress is a burden to himself. His shako is an anomaly, and if we had marines enlisted in seaman's clothes under our own Officers, I have no doubt that many of us would be glad to see the old marine done away with, but we certainly should look at any change of that sort with anxiety unless we knew what was going to replace them.

Commander W. DAWSON, R.N.: I cannot resist from offering my congratulations to the Institution in having such a very able and instructive paper read. I agree thoroughly with the great mass of what has been said. The only point on which I am at all inclined to take exception, is, as to the Royal Marine Corps. It will be in the memory of many Officers present, that about a year ago a paper was read on the question of marines *versus* blue-jackets by Major-General Schomberg; and I am sorry that he is not present to-day. I think it is an open question whether marines should be a part of a ship's company or not, but if marines are to be part of the ship's company in war, they must be trained as marines and not be mere soldiers. What is it that constitutes a marine? What converts a soldier into a marine? It is not only going on board ship and getting sea-legs. The sea soldier has a very difficult position to fill—that of learning to obey promptly the orders of Officers who belong not only to another corps, but to another profession—Officers whose ideas, manners, ways, and language, are utterly contrary and opposed to those of the Officers of his own Service. This subordination, to two widely differing sets of masters, is one of the most important distinctions in the training of a marine on ship board; and if the marines are not to be so trained, by all means let us do away with them, but do not let us have a corps called marines who have had no practice at sea, and have not acquired the specialities of sea soldiers. If we must have land soldiers, let us have them under their proper name. But what is it that distinguishes the two portions of the Queen's sea-service, and makes Naval Officers so long for the presence of the marine? It is that the marine has acquired some quality in the course of training which the blue-jacket does not possess. That invaluable quality which we all desiderate, he gets in the intervals of service afloat. In the interval of service afloat, whilst he is in reserve, the marine receives a course of disciplinary training which revives what he has unlearned at sea. Why on earth, as Captain Wilson has so well put it, should not a blue-jacket in the same interval be receiving the same invaluable disciplinary training, instead of deteriorating in subordination and general discipline in the very same period of reserve?

If these intervals of harbour service were utilized for seamen as for marines, instead of being utterly wasted, and worse than wasted, the seaman might receive a disciplinary training, making them the equal of the marine in that invaluable quality of subordination. We get the seaman originally from a better class than the marine recruit, and he is carefully trained from youth and moulded into whatever form the Navy chooses. A marine starts, say, about the age of 20, so that from that age we find the two classes starting from very different foundations; yet, such is the superior disciplinary training given by marine Officers, that we think the Navy could not exist without their aid.

There was another point I was very glad to see brought out, namely, the very wide distinction that there is between conduct and discipline, and I should like to see the same distinction enforced between drill and discipline. Drill may be employed very largely to promote subordination, prompt obedience, and discipline, but it is not in itself discipline, and it may be conducted as not to conduce to self-surrender and discipline at all. There is no reason why a most invaluable course of

disciplinary training should not be gone through, in the intervals of sea service, by seamen as by marines, instead of that idle time now spent in port, to the deterioration of good order and discipline, by which our seamen lose a golden opportunity which is now utterly thrown away. As far as organization, subordination, and discipline are concerned, seamen are really in a worse disciplinary condition when they return to sea than when they leave the sea-going ship. There can be no question but that when the men are disembarked from the sea-going ship at the end of a commission, they are in a far higher disciplinary state than when they are drafted to a new ship. Thus public money and public service is 'extravagantly wasted during considerable intervals of sea service in the case of seamen; whilst the very reverse is the case during the same periods with the Royal Marines; and I do not think it is possible to subject seamen to the same excellent disciplinary training which the marines gain on shore, until we have put the seamen also on shore in barracks. I believe thoroughly what fell from Mr. Shaw Lefevre, namely, that barracks would, in the long run, be far more economical than harbour ships. No habitation is more expensive than keeping a ship and her appurtenances afloat. Besides that, you must look to the waste of money on the men idling, and worse than idling, in hulks in our harbours. This costly time could then be usefully employed, and there could then be a continuous system of training—training at sea in seamanlike exercises and gunnery, in training in harbour in disciplinary exercises. I use the word "disciplinary," in an advised sense in contradistinction from drill, drill being merely the engine by which discipline is imparted. I was very much pleased with what was so ably stated by Captain Wilson, on this most important question. Very few naval Officers have the slightest notion of the chain of graduated authority which obtains between different ranks in the Army, and which ought to obtain between different ranks in our own profession. There is in the Queen's regulations, a certain page with a certain list of the gradations of rank of the different petty Officers. I am quite sure not a single petty Officer in the whole Navy could repeat the gradations of that chain. We repose as little confidence, respect, and authority in the chief petty Officers as in the ordinary seamen, and it is extremely difficult to discern any difference in their treatment. Let us compare the trust and authority reposed in the chief petty Officer of the Navy, with that of the Colour-Sergeant and the Sergeant-Major of the Royal Marines. Every naval Officer must be conscious of the wide difference in the position and treatment of these two. Compare again the trust, respect, and authority conferred upon the petty Officer of the Navy with that of the Sergeant of Marines, and the difference in the treatment of the two is obvious to all Officers. The treatment accorded to them by their Officers, makes a great difference in the authority and the position that they hold with reference to the men under them. You will thus understand what I mean by that chain of graduated authority which disciplines the marines and the Army, and which gives them that great advantage with reference to discipline, which makes us desire their presence as the backbone of organization and order in the Royal Navy. Whether we have the marine or not, is simply a question of subordination, order, and discipline. If we could, under any system of training, in the intervals of service at sea, bring men-of-war-men up to the same efficient disciplinary standard as the marines, then when they are in harbour they would be doing good to themselves, to the Service, and to the country, whilst being brought up to the state of obedience and order that characterise the marine forces. Were that done, I do not think there would be so much objection on the part of naval Officers to do away with the corps which is so deservedly the pride of the Navy; but so long as that royal corps remains, it should be a corps of real sea soldiers. Let them then go afloat; let them have their regular turn at sea.

The other question, as to the difficulty of training the boys who are now being brought up in harbour, I think might easily be got over by substituting a few frigates for some of the ironclads at present in commission. This would secure to them opportunities of learning more seamanship; but I am not prepared to sacrifice the efficiency of one corps in order to promote the efficiency of another.

One observation fell from Mr. Stirling Lacon which might be liable to lead to error. He spoke of the Naval Reserve having fallen in numbers. Most of us who have attended to these matters know that the Naval Reserve has recently gone up

very largely in numbers—17,000 at the present moment. Of course it is still very far below in numbers what most naval Officers would desire it to be; and as I am at present connected with the mercantile marine, I may be pardoned in saying that merchant seamen have been rather hardly treated to-day. There are, there is no question, a great number of blackguards, who are not seamen at all, in the mercantile marine, and a great many good-for-nothing long-shore fellows; but there are, on the other hand, a great many excellent well-conducted men and very excellent seamen to be found in the mercantile marine; and if these men have not joined the Reserve in the numbers we expected, depend upon it there is some good cause for it, which will probably be found in the regulations under which that force is constituted. I hope Mr. Shaw Lefevre's notion to bring men who have passed their prime in the mercantile service into the Navy, will not be carried out, for most naval men must know that it is extremely unpleasant to good merchant sailors to find themselves in a position of inferiority as learners of a new business on board a ship of war at an advanced age, and all the past experience of the Navy tells us that their entry is not for the advantage of the Queen's Service. If we could persuade men-of-wars-men to go into the mercantile marine, that would be another thing, but I do not see my way to persuading men-of-wars-men, after they have enjoyed the luxury of a ship of war, to submit to the hard life of the mercantile marine, in the miserable way that service is too generally conducted at present.

The CHAIRMAN: General Schomberg is unfortunately unable to be present to-day, but he has forwarded some written observations on the subject, which the Secretary will read.

Remarks by General SCHOMBERG: I restrict my remarks to that portion of Captain Wilson's lecture which treats of the Royal Marines as the first reserve of the Navy, and his proposals to render the marines a sufficient reserve, as they are now an efficient and ready one.

Five years ago I raised the question in this lecture room, "Are the Royal Marines a necessary auxiliary and reserve to the Navy?" The discussion that followed certainly supported my views, that marines are necessary to the Navy. I remind my present hearers that I left undefined how far the marines should be auxiliary or reserve; and that I especially remarked that I bowed to any necessary measure for the training of the Navy proper.

But, although on that occasion the votes of the Naval Officers present were much in favour of retaining the marines, I do not think the solution of the question has advanced one stage since my lecture in 1870.

It does not become me to discuss events that have occurred connected with this subject; but, in my opinion, we are still "halting between two opinions," to the detriment of the Navy and its limb, the Royal Marines; the lopping off of that limb, I still believe, would maim and cripple the body, the Navy.

The distribution of the Royal Marines which Captain Wilson proposes is almost exactly my own ideal for very many years; but I have always felt that such a proposal must come from a Naval, and not from a Marine Officer. I hail with hope the publication of these views by an Officer so distinguished as the lecturer, than whom no one can know more intimately the state of the Navy, and how the system of training the Navy works.

I do not undervalue in the least degree the Royal Naval Reserve, but, however valuable that force may be in the course of a long naval war, it can never be the first reserve of the Navy. The first reserve must be ready as your revolver for instant service; it should embark by telegraph; and at present I see no reserve of the Navy which can answer these conditions except the marines.

I doubt whether many individuals in England realise the stress a great naval war would throw on the Navy.

It is true that machinery enables one thoroughly trained man to do the work done by many in by-gone wars; but, on the other hand, we must consider seriously how much more we have to defend than we had in those times. First, the arsenals and hives of industry on our own coast, an empire in the east, a dominion in the west, a continent in the south, an island and a port in every sea, and a merchant navy carrying to and fro unheard-of riches.

The first reserve, in order to enable England to defend this, must be numerous as well as efficient; 10,000 to 15,000 men, ready to embark by telegraph, would not be an excessive number.

Captain Wilson's suggestion to garrison two of the home seaports entirely, and several foreign ports partially, with marines, would meet this completely.

I also am of opinion that there would be no difficulty in keeping up the training of marines in these garrisons, starting from our present marine system, which has been the gradual growth of many years, and enables us to take a man from the plough-tail, and, with two years' training, to send him on board ship, fit to compete with a gunner of the "Excellent;" no mean feat of instruction and training.

I believe that with this system, now so well matured, and with judicious measures to ensure a short sea training for these marine garrisons to accustom them to work hand-in-hand with the Navy, there would be no danger of the marines becoming a purely military force. There is no occasion to enter into details of these matters at present.

There would be no necessity for changing the organization of the Marine Service, or increasing the proportion of Officers to men; the force would still remain the most economical force under the Crown, and its distribution, as proposed, would remove its crying evils, viz., the non-employment of its senior Officers, and the idleness enforced on its Officers when embarked.

Captain R. A. E. SCOTT, R.N.: I wish to add that my own experience coincides with the views Captain Wilson has so ably expressed. As regards other speakers' opinions I do not think that the plan of bringing seamen from the Merchant Service into our Navy would be of much value. Rather than this, we want more boys, and these more highly trained than boys are at present. We now work all our heavy guns by machinery, and it is an increase of machinery that we must have recourse to in time of war to supplement a small amount of labour. Now the time when people can best master the working by machinery, and when they feel most interest about it, is when they are young. Instead, however, of being trained to use machinery, boys are merely drilled with handspikes and tackles; and that at a time when they should be instructed in manipulating the machinery of our newest guns or models of them. It has been said that we do not want many of such skilled gunners as those the Navy now possesses; but I think not only do we require more skill amongst our seamen-gunners generally, but that the low standard of skill is not creditable. We have only four large guns in some of our biggest ironclads; and hence the men firing them ought to be highly-educated marksmen. To encourage them to become so, their pay, and in fact the pay of all the men who are really skilled marksmen, should be very much increased. Then as to the disciplining the crews in our home ports. This might be carried out so as to be made interesting; and the drills to be mastered should be taught as if, to intelligent men rather than to machines so that instead of our seamen acquiring the art of firing very much at random, or at best by the rule of thumb, they would learn the principles of, and gain such accuracy in, laying guns, that on going on board ship they would be able to hit the mark almost as certainly with big guns as the marksmen at Wimbledon do with their rifles. Accuracy of fire is everything with the present armaments, and that cannot be attained by undrilled men. Therefore it is essential to educate them up to the highest point of efficiency in aiming, and that can only be done in harbour. As regards the cost, I believe, if it were pointed out that the Navy required more money (and we have just heard the weighty opinion of Mr. Shaw Lefevre), the money would be voted at once, and even more readily; still, if it were clearly shown that we have not half enough vessels to protect our commerce, no one can doubt that if a minister came boldly down to the House, and stated that the Navy was not in a satisfactory state, being dangerously deficient in cruisers, that the money would be voted and the necessary vessels immediately equipped. Were this done we should have no more of those panics which we are now so liable to; for the addition of a dozen or more powerful cruisers would render our Navy far superior to any combination of navies that could possibly be brought against us.

Captain WILSON: I shall answer, as far as I can, the objections raised to the paper categorically. First of all, I have to meet a very dangerous critic, Admiral

Willes. He thinks it is a pity I did not enter upon the whole question of the entire force of the Navy; but I purposely confined myself to the seamen of the Fleet, because I look upon them, as I have tried to explain in my paper, as the leaven which is to leaven the mass, and that they are the men who should be brought up to the greatest state of perfection in peace time, ready to meet the exigencies of war; they must be highly drilled men, and should take the same position in the Navy in war time that the Guard occupy in the Army. They should be as highly trained, or they ought to be as highly trained, as fighting men as our Guardsmen, or our colleagues the marines. I do think the greatest admirer of our present system would dare to say our 18,000 or 19,000 seamen are to be compared in drill or discipline to the 3,600 marine artillerymen whom we have in barracks at Portsmouth. Taking them all round, as fighting men they are inferior; and, at the very best, our Admiralty do not pretend to say we have more than one-half worthy of being classed as trained men; therefore we may naturally infer that 9,000 of our 18,000 or 19,000 men are untrained men, or so very inefficiently trained that they are not worthy of the penny a-day given to those classed as such.

As to the reserves of the Navy, I am at issue with Admiral Willes. In the first place, I do not think you can find 7,000 or 8,000 naval pensioners fit to go to sea. We pension off only some 300 or 320 men per annum. Allowing the waste on that number to be the same as we find it in the Fleet (or at twelve per cent.), it will be found that we can only have some 1,500 or 1,600 men between the ages of forty and fifty. Every person knows what a sailor is when he is pensioned, and I think no one will question it when I assert that not more than one-half of these are likely to be fit to be sent to sea; therefore, instead of having 7,000 or 8,000 naval pensioners, I say we have 700 or 800 really available.

Admiral WILLES: I included the marine pensioners.

Captain WILSON: I have confined myself strictly to sailors. As to the naval reserve men, we are supposed to have 14,000 or 15,000, but I do not think you can ever calculate on being able to get more in the first three months than from 4,000 to 5,000 of these men. Out of our 3,600 Coast Guard men, we might possibly be able to get 3,000 fit to go to sea, but a great number of them have stomachs, and are not fit to go aloft; they serve on until superannuated, therefore many of them are elderly men. Our total number of sailor reserves is therefore altogether about 8,500, which is all England has to depend upon as *bond fide* seamen reserves, and out of these we should not have above 3,500 who are really trained and disciplined men-of-war-men.

Admiral WILLES: The fewer the number the better for my argument.

Captain WILSON: As to where you are going to find the other seamen we hear of I cannot tell. Mr. Shaw Lefevre said, during the Russian War the French ships were employed in transport. That does not prove their men-of-war-men were not highly trained, or that they had not the men to man their ships; their men-of-war were used for transport, because they had not a mercantile marine which could provide proper ships. My argument is, therefore, still good, the French *had* the men, but we *had not* the men. We all know how our ships were sent up the Baltic during the war; I was then mate of the lower deck in a ninety gun ship, and I remember well how, one night, 350 fellows were marched on board who had never seen a ship, excepting from London Bridge. I say, if in time of war you want to expand your crews, it is infinitely better that your additional men should be *disciplined* and not raw hands, and that these men should be the marines. There is another point to which I wish to draw attention, namely, that reducing the large ships of the Navy is necessarily detrimental to the efficiency of the Service; every time you pay off a large ship, or an economising Government for instance reduces the Channel Fleet from eight to six, or from six to four ships, or who may take a ship away from the Mediterranean, in the same ratio as you decrease your large ships do you decrease the efficiency of the Service, because those large ships make the men-of-war-men.<sup>1</sup> The number of men does not alter, but the number of ships

<sup>1</sup> With barracks in which men could be disciplined and trained as *fighting men*, we should not have to depend so entirely on the large ships as we have to at present.



that make your *men-of-wars-men* are often increased or decreased; decrease your large ships, and your men are drawn into those which *absorb* men-of-wars-men, but do not *make* them. No ship that is not fully manned, and therefore able to carry out a systematic routine throughout, can possibly train or discipline men-of-wars-men properly.

I think, also, as Admiral Willes suggested, and it must be recognized more than it is at present, we must not complain because we have so many young hands or too many boys, or that we cannot get on in one ship, and cannot shift our topsail yards as quickly as they used formerly, because our crews are light; we must recognize the fact, that the Navy in peace time is a great school of training for war, and that every ship in the Service is a training vessel; such must be understood and clearly recognized by every Officer in the Service. I remember when I was a young commander, a First Lieutenant telling me he did not consider it his duty to train seamen; they ought, he said, to be seamen before they came into the Service. Officers do not always understand that it is their duty to teach, and therefore will not give that attention to the subject which it deserves.

Now we come to the question of discharging men. As I tried to express, I do not believe, especially on such stations as the Pacific and Australian, that any amount of punishment given to a man when he is *recovered* will ever prevent one deserting. I know, if I was a seaman, I should, under like conditions, very probably do so myself. I simply throw out the suggestion. I do not mean to say for an instant you are to publish an order that any man who wants his discharge is to get it with a stroke of the pen, but you might draw up a scheme by which a man would be able to get his discharge, say after giving three or four months' warning, after paying a certain sum, &c., &c. What is the case at present? The Admiral's ship in the Pacific has lost some 200 out of 300 of her seamen! What is the good of saying you will punish these men? Two-thirds of them, when they go, find on shore that they cannot earn their bread and butter, and if they could come back to you, they would. Let them have their discharge, let them go, and half of them will return to you, and never go again.

Then as to petty officers, I think myself we have too many of them. I would rather pay the men a higher rate throughout the Service, and reduce the number of petty officers. Captain Dawson spoke about the petty officers' position. I quite agree with him; but how can you give a petty officer his proper position when every third man of your able seaman is one? You cannot have every third man standing off. If you reduce the number of your first class and chief petty officers, and treat them as stand-off men, and the others as working petty officers, you may be able to do it. The position of petty officers has been very much improved of late years; in the "*Impregnable*," I was very successful in putting the petty officers in positions of command; they were the divisional officers, and I made them do everything exactly the same as a Lieutenant in a regular man-of-war, and they did it admirably well. When I took the training service I found but one set of people in authority, viz., the police. I said to them, "You men are here to *keep the law*, not to *make it*, and you will be good enough only to carry out "orders and prevent irregularities." That plan was thoroughly successful. Our petty officers were punished only by dismissal from the ship, and I found the better I treated them the more I raised them, and the more efficient and better they were in every way. As to the marines, Admiral Willes must understand I do not wish to see the marines done away with, that would be a result which I should regret very much indeed. The marines are admirable men, and are absolutely necessary to the Navy in *time of war*. I only say this: if you cannot—and you cannot—send all your seamen to sea, then let us make our *blue jackets* sailors, and not the *marines* into sailors. You want a certain number of deck hands who need not always be sailors, let them be marines; but a deck hand in peace time is acquiring his art as a sailor; therefore keep your sailors going as deck hands in peace, but replace them by marines in war. As a *fighting man*, a young marine is quite as good as one who has been to sea all his life.

Admiral Nicolson said something about the number of men—that we would not want so many, that we had more than was necessary to man all the ships we now had. When the American war broke out, the Northerners might well have



said, "Well, we do not want more men, because we have as many as will man all "our ships!" But where were they three months after the war? They could not get seamen, though they had at that time nearly as large a mercantile marine as we had, and they had to embark 18,000 landsmen on board their ships. If they had had to face a maritime Power of the third or fourth order, they would have been smashed. They had to put men into ships of all classes and build! You have in time of war, not only to man the ships you already have, but you must buy others right and left.

Mr. Stirling Lacon made some observations to which I wish to raise objections. In the first place, he speaks of the training of our boys, and says that each boy costs 60*l.* a-year, and merchant seamen boys cost only 19*l.* I think his estimate is high. I say our boys in the Navy cost under 40*l.* As to boys trained for the Merchant Service, I can simply say they are very inferior. I am not prejudiced against private ships, but the boys are no more trained, as compared with our boys in the Navy, than a mere militiaman is to a Guardsman. They are not even physically fit for our work. The whole of the merchant training-ships put together (including the "Warspite" do not supply us in the Navy with 50 boys per annum. You hear of Lords of the Admiralty going down and making long speeches about these vessels being feeders for the Navy, and all that sort of thing, but the fact is they are nothing of the sort. The boys are so much inferior in *physique* that we actually won't take them in the Navy; and as to the training, it is anything but complete. The very best lads, and who are worked up to a comparatively high state of perfection, are the boys who come from the "Warspite," but they are never able to pass higher than into the second class in the training service; therefore I think if Government does pay 60*l.* a-year for their boys, they get a cheaper article than the merchant training-ships for their 19*l.*<sup>1</sup> At the same time, I agree that the country does not get the value of its money in the training of our *seamen*. I believe that if the whole fabric were swept away—if you could wipe out the whole system (?) of training for the Navy—and re-establish it on a sound footing, get say half-a-dozen intelligent men together, they would put it on such a sound footing that you would have your men thoroughly instructed as fighting men, better instructed as sailors, better disciplined, and in every respect more efficient men; and this could probably be done at considerably less cost than at present. You will probably have noticed in the accounts of the recent wrecks what a large proportion of sailors were saved. The fact is, that the qualities you get in a sailor are made by the work he has to do, in a great measure, aloft in ships. You teach him self-reliance and brace his nerves. Look at that fine fellow as he clammers down the topgallant lift on a dark, stormy night to spill and furl his sail; what enormous self-reliance that man must have! Look how he must think for himself, and rely entirely on himself! To be a good sailor, a man must have plenty of determination and presence of mind, be ready of resource, and, above everything, he must think a-head. A sailor who thinks a-stern is of but little value. Take the case of these wrecks. Your landsmen lose their heads, but your sailors keep them. It was my good fortune to live through a disaster of that sort. What was our experience? 90 per cent. of the poor fellows who were lost, were lost because they were *shoremen*, and did not keep their heads. The bulk of the seamen and old marines were saved, and there was the means of saving every person there, and many more would have been rescued had they only kept their heads. That is one reason why I so strongly deprecate this large introduction of undisciplined shore element into ships. Your sailors are taught habits of self-reliance, and marines have their strict discipline; but your undisciplined men would rush about like a flock of sheep; and, in case of disaster, or in case of a ship being struck by a torpedo or anything of that sort, your 50 or 57 per cent. of undisciplined non-combatants would severely hamper, if they did not walk away with, all the disciplined element altogether. We were speaking also of highly trained men; and a good deal has been said about special guns crews.

<sup>1</sup> The fact is that, on an average, boys in private training-ships are kept for two years, and cost about 22*l.* per annum; therefore the *training* of a boy costs about 44*l.* for the Merchant Service, against under 40*l.* for the Royal Navy.

But fighting our guns is not all the work seamen have to perform; it is only one part of their work; they have to lay torpedoes, to land and storm fortifications, and to do a thousand and one things besides; and unless the seaman is fit to do all these things, he is incomplete. Fighting a big gun is only one part of his duty. As to stokers for fighting purposes in fleets, they are well enough as they are; but where are you, if you are going to land or use your boats, with 70 or 80 stokers, who do not know the breech of a gun from the muzzle, what are you going to do?

Captain FITZROY: Take the marines.

Captain WILSON: The marines are not enough; you have 60 marines, and you want, say, 360; and besides, when you land for any war purposes, are you going to take all the fighting element out of the ship, and leave only men unable to defend themselves or ship? If that argument holds good, why should sappers and miners ever be drilled at all? but they are as good fighting men as they are workmen, so should all men be in the Navy.

Mr. Stirling Lacon spoke about the (merchant) seamen breaking into ships' holds. What are our merchant seamen recruited from but from your prison ships? Can you wonder at the result? I do not.

Mr. Shaw Lefevre made some very telling remarks. When I was Captain of the Training Service, I received every assistance from him, and what is more, whatever money we wanted was readily granted; no expense was spared in that department by the Admiralty, and I never asked for anything which was not at once allowed, therefore I will say, in favour of the Admiralty, there was no parsimony, and Mr. Shaw Lefevre's views on all these matters were most advanced and liberal. The smaller our ships' companies are, and our crews must get smaller every year, the more reason is there why they should be highly and thoroughly efficient. We have no room for half-finished crews; every man on board should be a thoroughly trained fighting man, if he is nothing else, now they are not so. I do not complain of the number of our men; I think the number of our standing fleet is sufficient for peace time, but I complain of the quality; I do not think the quality is as good as it should be. Mr. Shaw Lefevre spoke of the French Reserves. If the French Reserve comprises all their maritime population, I can only say this, that they take the best means of passing an enormous proportion of them through their Navy, and what is more, in two years they put more drill into their men, and make them more thoroughly efficient men-of-war-men, than we do in six. They have a power to do so which we have not got. Their men are not volunteers, they are bound to be there and they can grind it into them; morning, noon, and night they are drilled. If we gave our men one-half of the drill they get, we should not keep a crew together a week. It is not our fault therefore, I am only pointing out how we stand.

Speaking of the desertions, I say there ought to be a committee appointed at the Admiralty to examine into the question of desertions. I feel confident that desertions arise, in a great measure, from the inadequacy of the pay; but there are besides two or three other causes that act as well; I think a very large percentage of the desertions come from the class of boys who are entered late. I tried the experiment of examining into the cases of all boys who deserted in the training service while I was there, and I found 70 per cent. of them were from those who entered over 16 years of age; I think you would find that 80 or 90 per cent. of deserters go from lads who enter late. Besides that, there is the insufficiency of food and also bad accommodation. How can we expect sailors to remain on such a station as the Pacific? The "Fantome" (one of a class of six or seven) went to sea in the depth of winter for that station, with no place for 25 or 30 of her crew to sleep in except under an open fore-castle surrounded with W.C.! If it had come on a hard frost when she was fitting for sea in the month of February, these men would have been frozen in their hammocks; their accommodation must be improved and more considered than at present when ships are designed.

I am strongly in favour of having barracks on shore, you could then afford to enter a certain proportion of men (and we must ultimately take to that course), because you could therein discipline them; you can never discipline men thoroughly on board ship.

Admiral SIR F. NICOLSON: You mean you would enter them older?

Captain WILSON: Enter *sea-faring men older* and discipline them in the barracks. I think that suggestion also, of passing all the men through the gunnery ships would be a great improvement. Captain FitzRoy doubted my assertion that the discipline of the Navy was not so good as it should be, and spoke particularly about the Channel Fleet.

Captain FITZROY: I mentioned my experience at Devonport during six weeks. I did not mention the Channel Fleet.

Captain WILSON: Though, as you may say, the marines are not as well dressed as the blue jackets, I will ask you whether you ever heard such a thing occur with them as this. There was a Colonel of a regiment at Devonport who came out on his horse to go his rounds. Three men belonging to one of the ships at Devonport were standing outside, and when he came out, one of them stood before him and called to the others, "Come here Jack, come here Bill, and look at the 'bloody 'Shah!'" I would ask you all, is that discipline?

The CHAIRMAN: At this late hour, and after this lengthened discussion, I think it would be unnecessary for me to make any remarks, except just one, which is this, that I should be very sorry, sitting in this chair, not to express an opinion adversely to any idea of doing away with the marines in any way. I think, not only are they a most deserving corps in themselves, and most useful at present on board ship, but there are many other reasons which have not been counted upon, and which I do not choose to go into at present, why I think, we should most decidedly retain the marines, and retain them as part and parcel of ourselves. The more pleasant part of my duty is to ask you to return our thanks to Captain Wilson for this most interesting paper, and also to those gentlemen who have taken part in the discussion. I feel it will do a great deal of good to get all our opinions out on these subjects, for we want a great deal in the Navy, and I think this will help us towards it a good deal. There is one point we may be very glad of, and that is, that our very good friend, Captain Wilson, did not desert in Australia.

# **Ebening Meeting.**

Monday, June 28th, 1875.

MAJOR-GENERAL J. T. BOILEAU, R.E., F.R.S., in the Chair.

NAMES of MEMBERS who joined the Institution between the 15th and 28th June, 1875.

## **LIFE.**

Holdsworth, Walter J., Lieutenant Lanark Yeomanry Cavalry.  
Thornburgh-Cropper, E. D., Lieutenant West Kent Militia.

## **ANNUAL.**

Sands, W. H., Captain, 6th West York Militia.	Birkbeck, Robert S., Captain, 6th West York Militia.
Hall, Samuel W., Lieut.-Col., Assistant Controller.	Crichton, Hon. Henry G. L., Captain, 21st Hussars.

## **ON THE PROGRESS OF BREECH-LOADING SMALL ARMS.**

By JOHN LATHAM, F.S.A.; Hon. Mem. Royal United Service Institution; Assistant Commissioner for Exhibitions of 1862, 1867, and 1873.

ON the 6th March, 1865, I had the honour of reading in the Lecture Room of this Institution a short paper on some early breech-loaders; and in this I was able to show that the earliest breech-loading small arms, of which the date can be identified, are of English manufacture, in the year 1537; and I traced the successive stages of development of breech-loading down to the year 1850. In the course of this paper I endeavoured to classify the principles of construction involved, and to define the general lines in which future progress might be expected. The favourable reception which was accorded to this little essay, which has been frequently quoted as a text book on the early history of breech-loading, has emboldened me to offer a short continuation of the subject down to the present time.

The Museum of this Institution is exceptionally rich in specimens of modern breech-loaders; and my original intention was to give a short explanation and notice of the peculiarities of each, but I soon found that this would be impossible within any reasonable limit of time, however useful such a work might be for reference. It would only weary you to give the detail of every plan which has been proposed and abandoned during the last twenty-five years; and I propose, therefore, to notice only such as seem to me to show some novelty of principle or advance in any direction.

At the close of my former paper I made a short classification of the different plans of closing the breech end of the barrel, as far as they had then been developed, and pointed out that, if we regard only the

way in which the aperture is closed, without including the means employed to secure the closing piece, there are in fact only three ways—a plug, or cone; a block, or wedge; or a tap action.

The first division of my former table was that of “chamber-loaders,” as distinguished from breech-loaders direct; this distinction has now become obsolete, or rather the detached loading-chamber has been developed into the present cartridge of metal, either simple or compound, often combined with pasteboard or other materials; but in all its forms it is the direct development of the old “chambers for gonnies” which were used four centuries ago for cannon, and adapted to fowling-pieces in the reign of Henry VIII.

The second division of my table—the loading-chamber attached to the barrel—has passed away for the present; though in the inventions of Mont Storm, Braendlin, and especially the very ingenious plan with a copper cartridge by Captain Selwyn, it gave promise of further development and success.

Among breech-loaders direct, the tap or cross-bolt action, though much improved by Prince and Perry, has died out, and the inherent objections to it are so great, that I do not think it is ever likely to be resuscitated.

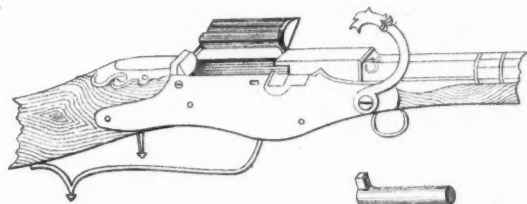
The two competing plans are now:—1st. That which closes the breech by a plug or cone. This is generally known as the “*Bolt System*,” from the way the plug which closes the breech is advanced between guides, and fastened by a partial turn on its axis, like an ordinary street door bolt. This is the plan generally adopted on the Continent, while the block system in different forms has found most favour in England and America.

In the table accompanying this paper I have arranged the modern plans, into these two main divisions, which are subdivided according to the way in which the closing mechanism is actuated, into eight classes. I have endeavoured to make the table more useful for the purpose of comparison by appending to each name, a figure showing the number of motions required to open, load, close, and fire the arm.

Let us begin with the foremost weapon of the bolt system, the Prussian needle-gun which has been so frequently described and illustrated in the Journal of this Institution, that I need not detain you by any explanation of its mechanism. It belongs to the subdivision *a* of our Table, having a bolt action, with the lock movement contained in the moving bolt. It has been lately the fashion to speak very disparagingly of this arm, which at least, through the events of 1864 and 1866, has been the means of converting the world to a belief in military breech-loaders; but under the name of Prussian needle-gun, we are really considering a whole series of arms. Its inventor, Herr Dreyse, never ceased to improve and alter the original mechanism; and just before his death, had succeeded in adapting it for the metal cartridge, which experience has shown to be a necessity for any breech-loader. It is the parent of the Chassepôt, Beaumont, the Mauser, the Vetterlin, and a host of other modern plans, and the most questionable part of its mechanism, the spiral mainspring, has been adopted in the Martini-Henry. In accuracy of shooting it was of necessity defective, as long

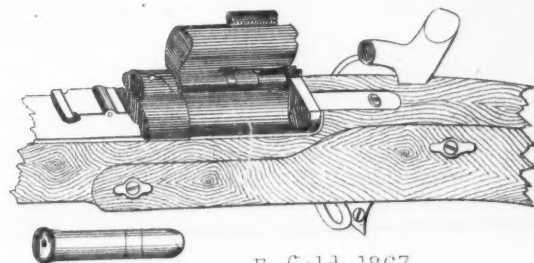
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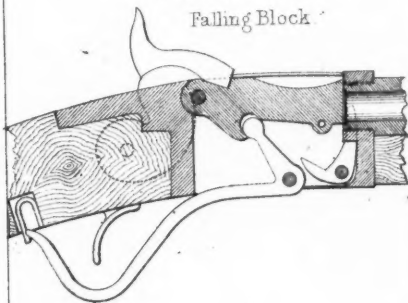
Tower of London 1537.

The Snider Rifle.

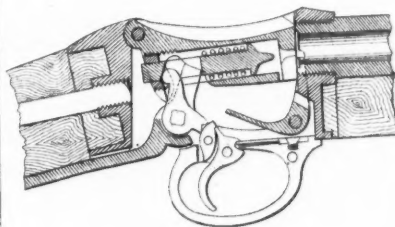


Enfield 1867.

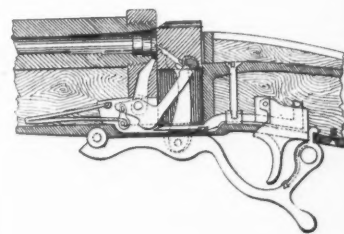
PEABODY.  
Falling Block.



MARTINI.  
Falling Block



HENRY.  
Sliding Block.



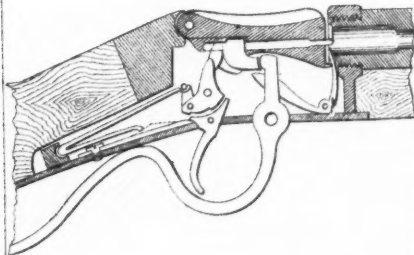
TRANTER.

WESTLEY RICHARDS.  
Falling Block

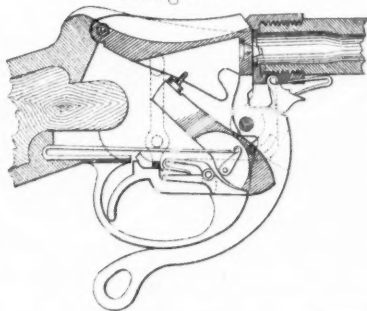
SWINBURN  
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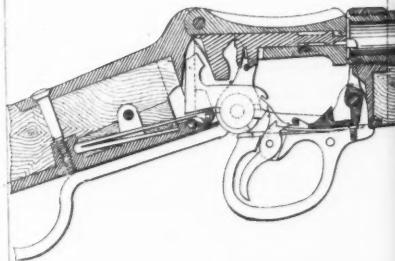
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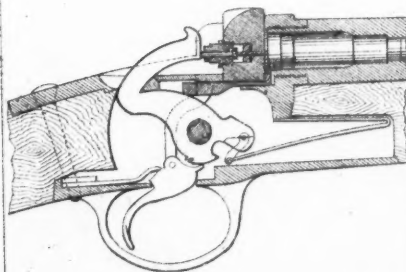
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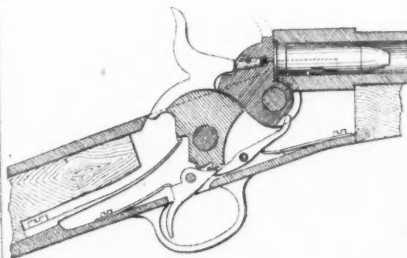
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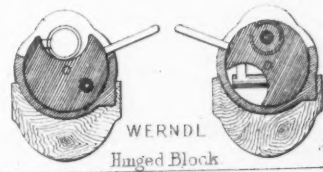
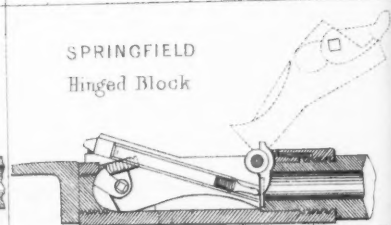
SOPER  
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REMINGTON.  
Segment Block



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as the "self-consuming" cartridge was retained; but at the date of its introduction, its accuracy was far beyond any of the military arms then in use; and for ease of loading, in all positions, and simplicity of manufacture, it is still unsurpassed. I have here a Prussian needle-gun which has been in my possession since 1845, specimens of cartridges, bullets, and sabots with contained ignition of the same date, and a target made with this gun and ammunition last Wednesday, after thirty years' keeping. This may be interesting as illustrating that some ammunition does not necessarily deteriorate with age.

We may now take as the type of the block system a breech-loader (Sharp's) which was submitted to the Board of Ordnance at Washington in 1850. This has a sliding block moved by the action of the trigger guard; the edge of the block was sharpened, and as it rose to its place in closing the arm, it cut off the end of a paper or linen cartridge previously inserted in the barrel. Some of these arms were issued to our cavalry regiments during the Crimean war, and it was found that the escape at the breech was very great, and that as the barrel fouled, the cartridge was impeded in its entrance into the breech, so that the sliding block cut away more and more of the powder as the gun grew dirty. Not only this, but if any grains of loose powder were left about the breech action, which was generally the case, these were ignited by the explosion of the cap, and flashed up in the face of the shooter; so in spite of the great strength and soundness of the action and its facility of manipulation, this gun was condemned through the defects of the cartridge. At the present time, as improved and adapted for the metallic cartridge in the "Henry" breech-loader, it is one of the best of the modern systems.

But both these plans and every other up to 1861 had a very unpleasant peculiarity, viz., that after a little use they were apt to become not only breech-loading, but also breech-firing weapons, the escape of gas at the breech being so great as to hinder anything like steady shooting with them. About this date, however, several plans of breech-loading carbines were issued to the cavalry for purposes of experiment, among which were Green's, a very simple and effective bolt action—Terry's and Westley Richards' plunger-bolt action. With all these, the ordinary nipple and percussion cap of extra strength to enable it to pierce the paper of cartridge were used, but a great advance was made in the cartridge itself by the introduction of a soft felt wad at the base, which acted as a washer to prevent the escape of gas, and also to some extent as a recoil check. After firing, this wad was forced through the barrel in front of the next bullet, thus wiping out the rifle at every discharge. Whilst this contrivance reduced the escape of gas and fouling of the barrel, it was liable to interfere with the accuracy of the flight of the bullet; but in many places where metal or pasteboard cartridge-cases are difficult to be procured, it is still in use for sporting arms.

In 1864 the English Government issued a circular inviting plans for the conversion of the Enfield rifle into a breech-loader. Of about fifty submitted, eight were selected for trial, of which five employed the copper cap and ordinary nipple, and three had pasteboard cartridges.

with metal case containing the ignition. Two of these were rejected as unsuitable or dangerous, and the Snider remained the only representative of the central-fire cartridge now universally adopted, but which was then just coming into use for sporting arms.

The mechanism of the Snider, which was finally selected, is precisely that of the earliest known breech-loading small arm, of which a very fine specimen in the Tower of London bears the date of manufacture, 1537. If you look at the sketch you will see that the method of opening and closing the breech-block is identical in these two plans, and the iron-loading chamber of the earlier arm is the precise equivalent of the metal cartridge of the present one. The Snider arm was submitted with the pasteboard cartridge with metallic base, which is still used for sporting purposes; but this was found unsuitable in many respects for a military weapon. The pasteboard would swell in damp weather, and split if too dry; and it had not sufficient strength to resist the heavy strain of the elongated projectile. Colonel Boxer, superintendent of the Royal Laboratory at Woolwich, devised a plan of metallic cartridge, to which the success of the Snider is chiefly attributable. Instead of pasteboard, he used a coil of thin sheet-metal, overlapping at the edges so as to expand with the force of the explosion, and fill the chamber, whilst the slight contraction on cooling would allow it to be easily extracted. The cartridge was withdrawn by a separate movement of drawing back the open breech-block to which a short claw was attached, and the gun required to be thrown over on its side to allow the extracted case to fall out.

This additional movement of extraction, however, was so much time lost, and, in fact, neutralised the saving effected by the abolition of the capping movement, and the Snider is therefore a six-motion breech-loader, the movements being, cocked, opened, loaded, closed, fired, and cartridge-case extracted.

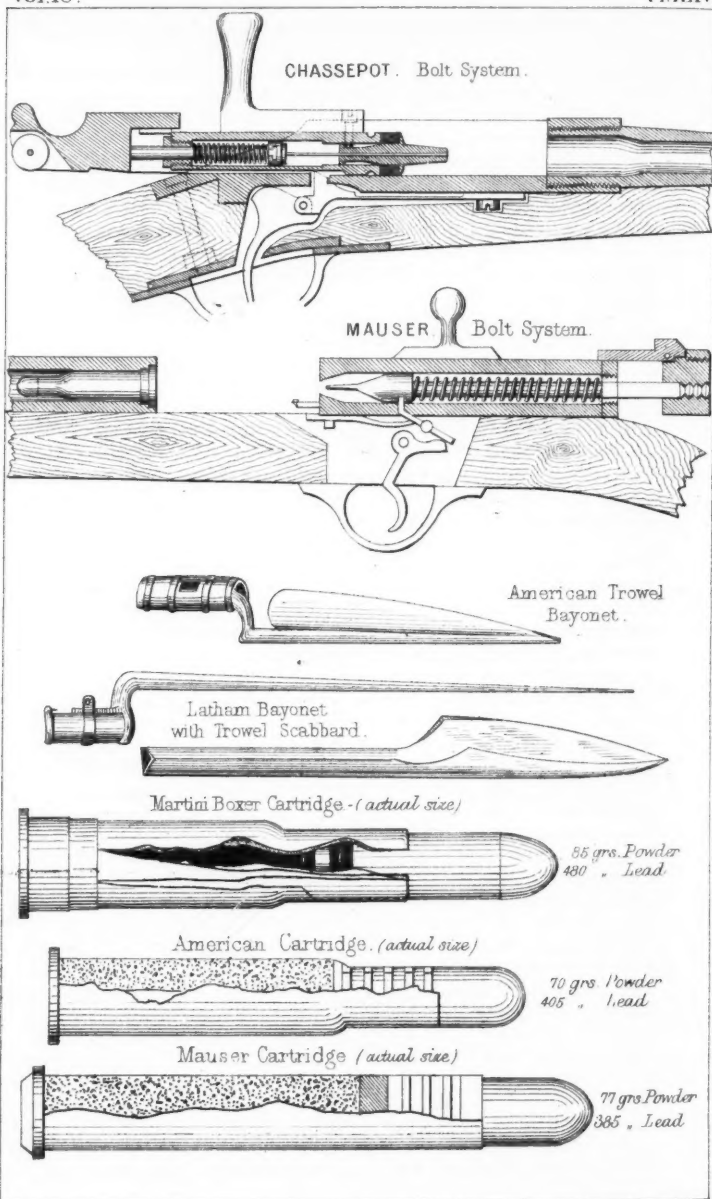
But for this defect, the Snider action, which is one of the best and soundest known, would, I believe, hold its own against any of the later systems, especially for large bores and heavy charges. The French adopted this plan largely for the conversion of their old muzzle-loading muskets of twelve gauge, and gave it the nickname of the "*Fusil à tabatière*"—the snuff-box gun—from the resemblance of the movement to the opening and shutting of a snuff-box. It has been largely adopted as a transition-arm by the Turkish, Dutch, Portuguese, and Russian Governments.

An interesting specimen in the Museum of this Institution (Hunt's patent) shows a very excellent spring extractor adapted to the Snider, which ejects the cartridge-case by the opening of the breech-block without a separate movement; and, with this addition the Snider can be easily made a five-motion arm.

The Belgian Government adopted, in 1867, a plan known as the *Brandlein-Albini*, in which a hinged breech-block turns on an axis above the barrel instead of at the side, resembling, in appearance, the *Mont Storm* chamber-loader. A jointed bolt attached to the hammer serves to impel the striking-pin against the cartridge, and, at the same time, locks the breech-action firmly in its place, and the cartridge

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is extracted by two short claws which are thrown forward by the movement of the breech-block on its axis.

The American Government decided upon a plan for the conversion of their muzzle-loaders, which is known as the Springfield system, and may be described as a combination of the Braendlein and Snider plans, having the movement of the first with the striking arrangement of the second. It is illustrated in section in the drawings, and I shall have occasion to speak of it more particularly further on.

The tests applied to the Snider system to ascertain its powers of sustaining rough usage were very severe, comprising dusting the action with sand, drenching with water, rusting for a week in the open air, firing 500 rounds without cleaning and with cartridges purposely weakened and made defective; all of which, as well as the further test of time and clumsy usage, it has triumphantly withstood. The Braendlein and Springfield systems have stood an equally severe trial.

In the meantime, the French had improved the Prussian needle-gun, retaining the bolt action and general features of the mechanism, but adding a more convenient thumb-piece for cocking, a secure half-cock to enable it to be carried when loaded, and an india-rubber washer, to prevent the escape of gas. The cartridge was on the so-called "self-consuming" plan, having a linen envelope, and made strong enough to stand rough usage much better than the paper. But experience has shown that no cartridge can be trusted to consume entirely in the barrel, under all circumstances—the metal conveys the heat away so rapidly as often to preserve the thin paper in contact with it from the combustion of the powder.

The Chassepôt Rifle has a steel barrel, with a small bore .435", a heavy powder charge, 85 grains, and a light bullet, 380 grains. It, therefore, leaves the barrel with a very high velocity, but the bullet is too light to retain this advantage for any great distance, and in the trials made in this country, its shooting was decidedly inferior to that of the Snider. It is said to have an effective range of 1,800 yards, and is a five-motion gun, viz., cocked, opened, loaded, closed, fired.

This was then the condition of matters at the close of 1867. Nearly every European country, with the exception of France and Germany, had adopted some form of the hinged-block system, as a temporary expedient for converting their muzzle-loading arms; in almost every case retaining the old lock and hammer (five-motion plans). The experience of daily use, however, brought out minor defects and difficulties. The breech systems worked well and soundly, but the difficulties clustered around the cartridge and extractor. We began to perceive that the action of the exploding powder in a metal case resembled the effect of a "swedge," and drove the metal into such close contact with the chamber that it was as if it were riveted to its place, and occasionally a cartridge would hold in so firmly as to defy the extractor. To obviate this, the cartridges were made more or less conical; they were encased in a paper envelope, which was waxed or lubricated, but without overcoming the evil. It was principally this difficulty which attracted attention to a plan of breech action, invented



by Mr. Peabody, of Boston, Mass., U.S.A., and patented in England in 1862, and in fuller detail in 1865.

This is generally known as the falling-block system. The action of the breech-block is similar to that of the knuckle-joint of the human hand, and when I bend my fingers towards the palm and then straighten them, the bones move precisely as the block of the Peabody Rifle moves in its morticed seat. In the section shown, I have purposely omitted the firing apparatus, so as to render the breech movement and the action of the extractor more clear. The block moves on an axis above and at right angles with the bore of the barrel, and is actuated by a long lever moving on a centre behind the trigger-guard. As the lever turns, its shorter arm draws the block in a downward direction; from which movement this plan is generally known as the "falling-block" system. From the circular direction in which it moves, the pressure on the base of the cartridge is instantly relieved, and the liability to jam from expansion of the base of the cartridge, which sometimes occurs in the sliding-block system, is obviated. The recoil is received only on the recess of the knuckle-joint, and the pin on which the block turns has no strain upon it, except in the case of a defective cartridge, and friction is reduced to a minimum, as the block comes in contact with the barrel only at the moment of closing.

The great strength, simplicity, and handiness of this movement recommend it at first sight, but the extractor is so especially adapted to the requirements of a metallic cartridge that this has been, I think, one of the principal causes of the favour with which this plan has been received. You will see that, while the first blow of the falling-block on the bent extractor-lever starts the cartridge-case from its hold in the barrel, the further descent of the lever acts with increasing velocity to the end, and expels the empty cartridge-case with sufficient force to cause it to fly up the loading groove, without any assistance from the shooter. To use a rough illustration, it begins with a push and ends with a kick, and some such double movement has been found necessary to overcome the bite of a cartridge-case which has been fired with a heavy charge in a small bore.

By a small bore we now understand any barrel whose calibre is less than  $\cdot 5$  = half-an-inch, a size which, thirty years ago, was considered in England only fit for a pop-gun or toy rifle. We prided ourselves on having the heaviest arm, with the largest barrel, of any nation in the world. The old Brown Bess, or smooth-bore musket, was 12 gauge, equal to  $\cdot 75$  inch, and it is said this bore was fixed on the dictum of the great Duke of Wellington, that thus we could always use the ammunition of any other country, whilst they could not get our large bullet down a smaller barrel. You may judge from this that accuracy of shooting was not much considered. In fact, Brown Bess with the service cartridge was not of much use beyond 50 yards.

In the Minié Rifle which succeeded it, and the bore of which was 14, with a conical projectile and iron cup in the base, we had one of the most effective weapons at short ranges ever introduced, but, as the advantages of accuracy were beginning to be considered paramount, it was abandoned for the Enfield Rifle, having a bore of  $\cdot 577$  and a

turn in the rifling of 6 feet 6 inches, equal to half-a-turn in the length of barrel. This was effective, as a muzzle-loader, up to 900 yards, and when converted to a breech-loader, on the Snider system, to 1,200 yards.

In 1856, Lord Hardinge, then Commander-in-Chief, invited Mr., now Sir Joseph Whitworth, to investigate the laws and properties of rifled arms and their projectiles, and the result of his investigations was—

1. The best form of rifling is that of a polygon; by preference, a hexagon, which admits of the employment of projectiles of different lengths, densities, and shapes, and of any material from soft lead to steel, the projectile being fitted to the form of the rifling; but expanding bullets can be fired from the same barrel.

2. For an ordinary military barrel, 39 inches long, the bore should be .45 inch, with one turn in 20 inches, which is sufficient for a range of 2,000 yards. The gun responds to every increase of charge, by giving better elevation, from 70 grains up to 120 grains, when the recoil becomes more than the shoulder can bear, with the weight of the service musket.

3. With all expanding bullets proper powder must be employed. A slowly igniting powder is desirable for a hard metal projectile, but with a soft metal expanding projectile, a quickly igniting powder is requisite.

I have given these statements, as nearly as possible, in Sir Joseph's own words, as we shall see that every further experience confirms the accuracy of them, and I am convinced we are only beginning to understand their full application.

The Whitworth rifle was one of the most remarkable strides ever made in projectile science. Its performance with the hexagonal bullet had never been equalled or even approached by any previous weapon, but the mechanically fitting bullet was found to be unsuitable for quick loading from the muzzle; and Mr. Alexander Henry, of Edinburgh, introduced a plan of rifling, based on the Whitworth principle, but more suited for an expanding projectile, in which the corners of the polygon, to which he gives seven sides, are filled up with a projecting tooth extending to the original diameter of the barrel, so that the projectile at its first expansion, is grasped by fourteen surfaces or points of direction. This is the plan now generally adopted for breech-loading rifles.

But the difficulty of combining the mechanically fitting projectile with the mechanism of breech-loading, has been lately overcome by Sir Joseph Whitworth, by the employment of a metal cartridge, the fore part of which containing the bullet, is hexagonal in shape, the after part being of the usual slightly conical form. This can be loaded with the same facility as a circular cartridge, and of course the projectile can be made of any material up to steel itself, as it does not require any expansion to fit the barrel. The terrific force of these projectiles may be seen from the specimens now in the Institution, showing half-inch iron plates completely penetrated by Whitworth steel projectiles at angles of  $0^{\circ}$ ,  $35^{\circ}$ ,  $45^{\circ}$ ,  $50^{\circ}$ , and  $55^{\circ}$ .

Many other excellent systems of rifling, the Metford, Rigby, and

Ingram, I am compelled to pass without remark, but one of the latest modifications of rifling, that of Mr. Murphy, introduced by Captain O'Hea, I shall have to mention when I come to speak of the recoil of these arms.

We have now arrived at the year 1868, when a Select Committee was appointed to consider the question of breech-loading small arms, with a view to replace the Snider (which, you may remember, was only the Enfield barrel converted) by a rifle embodying the smaller bore and quicker twist, which Whitworth had proved to be so much superior. In response to an advertisement, a large number of arms were collected and examined, and after a preliminary trial ten were selected. Of these plans, four—the Kerr, Wilson, Carter-Edwards, and Bacon—were on the bolt system, and the Henry, Berdan, Money-Walker, Martini, and two systems by Westley Richards represented the block. During the trials which were purposely made with defective cartridges, two of the bolt systems exploded prematurely, and the others showed signs of weakness, which induced the Committee to reject this principle altogether, as dangerous.

When, as in all bolt guns, the mechanism employed to guide the capped cartridge into its place, has the same movement as the mechanism which fires it, there is always danger, especially in a barrel heated by firing, that a very sensitive or projecting cap may be exploded prematurely; and in such a case, the bolt action which works nearly in a direct line with the eye of the shooter in aiming, is undoubtedly the most dangerous. In the block system any accidental explosion is directed upwards as well as backwards, and would go over the shooter's head instead of towards it.

The further competition was, therefore, restricted to the block systems. After the exposure, endurance, and rusting tests, these were reduced to the Henry (sliding block), and Martini (falling block). They were equal in safety and strength, and the Henry far surpassed the Martini in accuracy, but the Martini was a self-cocking arm, and consequently required one motion less to load and fire than the Henry. A prejudice is generally strongest when it is on the point of collapse, and precisely as the former Committee chose the cartridge with contained ignition, when "everybody" thought it too dangerous for a military arm, so this Committee chose the self-cocking mechanism which everybody, *except those who had witnessed the trials*, thought would be too dangerous for adoption. I think we are all too apt to form opinions, and then look out for facts to support them, instead of taking the facts first, and I must confess that my old prejudice against a self-cocking arm, has not survived the experience of the last four years. It is still a moot point, however, and the Americans have only just, after a careful trial, decided to retain their five-motion Springfield plan, which requires to be cocked as a separate movement.

A specimen of the Henry five-motion side-lock breech action on the plan tried by the Committee is in the Museum of this Institution, and by the kindness of Mr. Henry, I am able to place beside it one of his new self-cocking military breech-loaders, which is also illustrated by a sectional drawing. You will see at once the compactness of this action

and the ease with which it works as compared with the Martini. The straight line in which the extractor moves allows a cartridge of any length to be used, and the facility of cleaning from breech to muzzle, so as to push the dirt away from instead of into the breech action.

So the Committee took the Henry barrel, which was the best before them, and the Martini breech action, and proceeded to adapt them to each other. There was no difficulty with the barrel which performed equally well with any breech action, but their difficulties began in the adaptation, and the cartridge, as usual, was the first difficulty. The bore of the barrel was  $\cdot 45$ -inch, and to hold the necessary charge of powder, had to be made  $3\frac{7}{8}$  inches long, including the bullet. This great length was of no importance in the Henry sliding block action, in which the cartridge case is ejected in the direct line of the barrel, but in the Martini the case has to be propelled up the curved surface of the breech block, and the whole action had to be made so long as to materially increase the weight of the weapon. To lessen this, the cartridge was made bottle shaped, having at the base the old Snider diameter of  $\cdot 577$ -inch, and contracting to  $\cdot 45$ -inch in front, to embrace the bullet. This enabled the breech action to be shortened and some weight saved, and before finally adopting the gun, 200 were issued for experimental service in all parts of the world. Miss-fires, at first frequent, were remedied by increasing the force of the mainspring from 26 lbs. to 40 lbs. The paper cover of the brass-coiled cartridge was dispensed with, and minor alterations were made in the stock, form of strikers, &c. Finally, the weight of the gun was reduced from 9 lbs. 7 oz. to 8 lbs. 12 oz., which is lighter than the long Snider rifle. It is, however, six inches shorter in the barrel, and is, I believe, shorter than any other infantry arm now in use.

The mechanism of the Martini breech-action is shown in the sectional drawing before you. It is in substance the Peabody, but a very high degree of ingenuity has been employed to make it into a self-cocking arm, with the lock contained in the falling block. The striking pin is moved by a spiral spring, which is drawn back by the movement of the lever in opening the arm. The tumbler is held by a tumbler rest and sear, which retain it at full cock when the breech is closed. This tumbler works on the same axis as the lever which moves the breech block and the full pressure of the spring, until it is caught by the sear, is bearing on the lever axis. The least failure in the action of the sear and tumbler bent, disables the whole action, and we shall see that a slight derangement of these points, caused the discomfiture of the Martini in the latest official competition, in which it was tested against other plans.

In the present breech action of the Martini as shortened to admit the bottle-shaped cartridge, the force of the spiral mainspring has to be exerted within a space of only  $\cdot 42$  inch, and to get the necessary blow to explode the cap, this spring has to be made of great strength, about 14 lbs. at bearer and 40 lbs. when compressed. This produces a harsh dragging action of the whole mechanism, which is especially unpleasant in use.

I purposely forbear to enter into the vexed question of spiral *versus*

flat mainsprings, except to say that there is no reason why a spiral spring, made and tested with the same care that is exercised at Enfield should not do its work as well as any bent mainspring, though it cannot last so long.

The weight of this strong spring upon a tumbler which has to work in so confined a space would be dangerous if the tumbler worked directly into the sear as in the original model of the Martini, which has been known to explode a cartridge by the accidental jarring of the heel-plate on the ground. To prevent this and improve the pull-off by lessening the dead weight on the sear-nose, the tumbler-rest, invented by General Dixon, has been introduced, and has greatly modified this difficulty, though it has not entirely removed it. I have known a variation in the pull-off of more than five lbs. occur in a day's practice, and this is a serious matter at Wimbledon, where the trigger of the rifle may be tested at any moment, and the shooter be disqualified if it is found too light. A very excellent improvement in the trigger by Mr. Edge, (models and drawing of which are before you,) is far more safe than the service arm, and gives a really smooth and regular "pull off." This remedies one very great objection to the Martini action.

There is another point which has been brought prominently forward in connection with the Martini, and has occasioned, perhaps, a greater outcry than any other of its peculiarities. I allude to the very unpleasant recoil of this weapon. There is no doubt this defect exists, and that it is perfectly unnecessary, is proved by an experiment which anyone may try. I can say from personal experience that you may fire a similar bullet and charge of powder to those in the Martini cartridge from the Henry, Tranter, Swinburn, Soper, or half a dozen other breech-actions with far less recoil.

The cause is not far to seek. The Martini is an engineer's gun. By this I mean that it is simply a machine for receiving, firing, and ejecting a cartridge; and whether it has to be screwed in a vice or fired from a machine-rest or from a man's shoulder does not appear to have been considered at all.

In a sporting gun we fit the length, bend, throw-off, and grasp of the hand most carefully to suit the user. Of course such nicety is inadmissible in a military arm, but some approach might have been preserved to the old traditions of gun-making. The Martini is little more than a barrel and breech-action screwed into a rough plank; and an old flint musket of William III is a more comfortable arm to fire from the shoulder. First, in the Martini a solid bolt passing through the stock from the butt to the action directs the whole recoil on to the shoulder without the slight relief generally afforded by the elasticity of the wooden stock. Then the hand of the Martini is so constructed (quite unnecessarily) that it is impossible to get a comfortable grasp of it, and the thumb of the shooter, on which the steadiness of the pull-off so much depends, is thrust up to the sky as if in despair at finding itself so much in the way. The fore end where the left hand should control the upward "kick" (which is distinct from the direct recoil) is made so deep and sharp-edged that it would require the

grasp of a Chimpanzee to hold it firmly; and when the Captain of the Scottish Eight at Wimbledon described the gun as a "miserable malformation," he only did it justice as far as the shape is concerned. But the excellence of its shooting is incontestable. The soldier has now a weapon capable of competing in accuracy with the most expensive match rifles of a few years ago; and, as far as I can learn, the men are generally very fond of their new weapon.

The breech-action is safe and strong, but undoubtedly too complicated; and here I must say a word in explanation. I do not regard the number of parts in any piece of mechanism as necessarily a complication. In fact it frequently simplifies the working of a machine to substitute two pieces for one when a double function has to be performed; but the parts of the Martini are so inter-dependent, and rely so much on their mutual adjustment, that a very slight derangement will throw several points out of gear. Thus after the gun has had some wear and has to be re-assembled after cleaning, we find that if the block be too high, the bearing-surface of the lever has to be altered to adjust it, but if more than one hundredth of an inch is required, a new lever must be fitted, if too low, a hundredth of an inch may be added or a new lever. If the striker is too high or too low, a hundredth must be added or taken off, or a new lever. There are three points in the extractor which may require adjustment or a new extractor. The trigger-nose and bent also require careful adjustment, this is the case in all gun-locks—but the trigger-nose must on no account be shortened as this *affects the loading position of the block*; and, as all sportsmen know, the trigger-nose is the part of all others most liable to be damaged by careless usage.

It is because this complexity is due to the introduction of the spiral mainspring and the cramped position in which it works, that I should be glad to see this arm adapted to the flat mainspring which can easily be done without affecting the real excellencies of the system, the falling block and the powerful extractor.

In 1869 Martini patented a modification of his breech-action, in which he introduced a flat mainspring; and, in 1870, Tranter produced an excellent system of falling-block rifle, which was exhibited at the Wimbledon Meeting of that year, and which is shown in section in the drawing.

The lever is here formed by the trigger-guard, which brings down the falling block and cocks the arm. The mainspring is of the same form as that of an ordinary gun-lock, and when the breech-block is closed, the end of the lever forms a direct vertical prop to support its position in the axis of the barrel, while a projecting lip at the end of the block prevents its being thrown too high; and, at the moment of firing, the striker and striking-pin are bolted by the action of the trigger, so that no accident can occur from the exploded cap being blown back.

About the same time Westley Richards brought out a plan of falling-block mechanism using the ordinary bent mainspring, and giving a direct blow from the hammer-head on to the percussion cap, instead of transmitting the force through a striking-pin. To effect this, the



lever is placed in front and over the trigger-guard, instead of behind it as in the Martini. The hammer works in a hollow in the underside of the breech-block, and the point of it strikes through a small hole in the centre of the block-face on to the cap. This plan has answered perfectly with very heavy charges, and is far more convenient to handle than the Martini.

Another excellent plan of falling-block rifle is the Swinburn, which was very successful in the competitions at Wimbledon last year.

In this plan the external parts of the Martini action are retained, except that the unhandy grasp is modified into a convenient shape, and the trigger is brought half an inch nearer to the finger of the shooter. The hand-lever works behind the trigger-guard as in the Martini, but the internal arrangement is far superior, as the breech-closing, firing, and extracting apparatus are kept carefully distinct, and the friction which is so enormous in the Martini is reduced to a minimum.

Each of these three plans preserves the great advantage of the ordinary arrangement of mainspring and hammer in a gun-lock, viz., the increased velocity with which the hammer-face moves as compared with the travel of the mainspring. In all spiral-spring systems the velocity of the striking-pin is only equal to that of the spring itself, which must therefore be of greatly increased strength to ensure ignition of the cap.

Dr. Thayer has a very simple plan for converting the Martini to a bent mainspring lock like that of an ordinary gun, which he will explain to you personally at the conclusion of my paper.

There is a section of a plan by Zeller on the table, which closely resembles Tranter's, but with the shape of trigger-guard modified, and the substitution of a straight for a bent mainspring.

At Wimbledon, last year, there were three principal prizes open to breech-loaders. The first and most valuable of all, was the Queen's prize, at which only Government-made Martini rifles are used, and the average shooting of the first 46 competitors was at 900 yards, 43·65 per cent. of the highest possible score; and at 1,000 yards, 35·02 per cent.

The Secretary of War's prizes, at 900 yards, are open to all military breech-loaders, and the first 46 men in this competition made 75·72 per cent. of the highest possible score, an improvement of 32 per cent.

In the Henry prizes, open to all military breech-loaders at 1,000 yards, the first 46 men made 66·30 per cent. of the highest possible score, an improvement of 31 per cent.

The rifles used in these open competitions were the Martini, Swinburn, Henry, Metford, and Soper.

The last-named of these rifles, the Soper, is one which combines a very high degree of simplicity and accuracy with the greatest rapidity of any breech-loading arm yet introduced. It is closed by a block turning at the side of the barrel like the Snider, and moved by a short lever on the right side, which can be easily pressed down by the thumb, on this lever being depressed through an angle of only 55 degrees; the breech-block is opened, the striker retracted, the hammer set at



full cock, and the empty case thrown out. It has an excellent extracting and ejecting movement which, like all the rest of the mechanism, is very simple and sound. This rifle has been loaded and fired sixty times in a minute, which far exceeds the performance of any magazine gun. It can easily be fired thirty times a minute with good accuracy, and it took the Bass prize at Wimbledon last year. In any future competitive trials this rifle is sure to take a very high place.

I have said that the principle of bolt guns, though adopted in France and Germany, has been, since its condemnation by the Government in 1868, very little heard of in England. It has been much improved, however, and the last gun on this principle introduced by Mr. Green, who was one of the competitors in the Snider trials, and which he has named the "British Breech-loader" is one of the best plans of the kind I know. It is made as a five-motion breech-loader or as a self-cocking arm (four-motion), and carries a metal cartridge which is very cleverly protected from any chance of accidental explosion in closing the breech.

Curiously enough, whilst we condemn the bolt action in England, we find that both the falling block, and sliding block systems, in fact all plans working by means of a lever descending below the line of the trigger guard, have been just as summarily condemned in France and Germany, for this reason, that when, in skirmishing, the soldier is concealed by only a shallow cover, such as a slight ridge of earth, or dry ditch, he cannot make the necessary movement to load and fire without exposing himself more than with the bolt or hinged-block plans, since he must move the rifle from his shoulder to load, and it is argued that as the majority of shots in all future warfare will be fired from under cover, this is an important matter. No doubt it has received full consideration on the part of our authorities, and the commissions which have considered the subject, though I do not find any notice of it in their published deliberations. I only mention it as one of the many points in which the soldier should control the mechanician in devising an arm for military service.

In 1872 a board of officers was appointed to select a breech system for the military service of the United States. Ninety-nine arms were received and experimented upon by them, among which were the Berdan (Russian), Needle Gun (Prussian) Chassepôt (French), Martini Henry (English), Mauser (German), Werndl (Austrian), Werder (Bavarian) and Vetterlin (Swiss magazine musket). Thus the whole of the principal systems in use in Europe were represented, as well as the American plans, and the competition may fairly be considered an international one. Before proceeding to state the results of it, I may briefly describe those arms which we have not before considered, and of which there are specimens on the table before you.

The Berdan (Russian) is a hinged-block gun having five motions, viz.:—cocked, opened, loaded, closed, and fired; has a spiral main-spring, with extractor and ejector adapted for the solid metal cartridge which Colonel Berdan was the first to introduce. It is a thoroughly sound, solid and efficient weapon.

The Werndl, used by the Austrian Army, introduces us to a novel motion on the block system. It has a rotating block turning on an axis parallel with and underneath the centre of the barrel instead of at the side. This block being turned one quarter round on its axis brings a cylindrical groove opposite the end of the barrel, through which the cartridge is inserted—by reversing the movement of the block, the breech is closed, and on firing the cartridge is exploded by an oblique centre pin struck by an ordinary percussion lock and hammer.

The Vetterlin (Swiss magazine musket) is of formidable weight, especially when charged. It uses a bottle-necked rim-fire cartridge of small capacity, and has three motions as a magazine gun and four when used as a single loader, viz., opened, loaded, closed and fired. If the cartridge is drawn from the magazine, of course the loading movement is saved.

The action is on the bolt principle and similar to that of the needle-gun. Drawing back the bolt, compresses and cocks a spiral mainspring, and the cartridge when used as a single loader, is inserted and guided into its place by reversing the movement of the bolt in the usual way. But when the magazine of cartridges contained in a tube under the barrel is put into communication with the breech action, the movement of opening the bolt, throws up a carrier containing a cartridge, which is guided into the barrel on closing the arm.

The Remington rifle which is a great favourite in America, and is used in the Swedish, Spanish and other armies, is closed by a block forming a segment of a circle, and turning on an axis below the barrel. This is locked by a second block turning on a lower axis, and the combination of these two blocks resists the backward force of the explosion. It is thus a five-motion breech-loader, requiring a separate cocking movement. The mechanism at first sight does not give the idea of sufficient strength to resist a heavy charge, but in no case has it failed to stand the severest tests, and it has actually been fired with the enormous charge of 750 grains of powder and 40 bullets, occupying the whole length of the barrel.

The Mauser, which is the latest modification of the bolt system adopted by the German Government has excited a great deal of interest in England, it being known that this arm was being made in large quantities in this country, and that the manufacturers were bound not to disclose any particulars of its mechanism. My request for information to those gentlemen was met by a very courteous refusal and expression of regret that this was the case. But the Emperor of Germany and King of Prussia having presented a specimen to the Museum, I am now enabled to describe it. The Mauser resembles in appearance both the Prussian needle-gun and the Chassepôt. It is a self-cocking arm, having four motions,—opened, loaded, closed and fired. The opening is effected by raising the handle of the breech-bolt to a vertical position and then drawing it back. This compresses the spiral mainspring and cocks the arm, and the novelty of the action consists in the way this is effected. The breech-bolt is divided into two parts, to the hinder of which the firing pin is attached, while the fore part contains the spiral main-spring.

These parts are joined by two interlocking cam surfaces which move on each other when the bolt is turned round, and separate the parts till the firing pin end is caught by the sear. When the bolt is turned back to its place the firing pin is free to move forward without any resistance from the cam surfaces, whose curves are now opposite to each other, and can enter without friction. A movable frontpiece, called the recoil-block, moves with the bolt, but does not turn with it, and thus serves as a safeguard against accidental discharge, as the pin can only pass through it when the gun is cocked, and the bolt fully home.

This is a strong sound movement which is instantly understood by a soldier accustomed to the needle-gun, but it is a mistake to suppose, as has been asserted, that it is either a better arm than the Martini, or that it is perfectly free from the sources of danger which exist in all bolt guns. The Germans are far too practical and clear sighted to make any such claim for it. In a very complete and elaborate explanation of the Mauser system, by Captain Hentsch, of the Prussian army, published at Berlin in 1872, he concludes by saying that the future of breech-loading belongs to the block system, and that the cylinder (or bolt) movement may be considered as antiquated, and no longer suited to the times. He only claims for the Mauser system that it is certainly the most complete and best construction of its class.<sup>1</sup> I am compelled to join issue with him even there, for I cannot help thinking that this weapon (Green's) does the same work as efficiently with a simpler movement.

The Mauser has a calibre of .43 inch, is rifled with four circular grooves, and is fired with 77 grains of powder and 385 grains of lead. The bore, bullet, and powder-charge are therefore less than in the Martini, but the arm itself is much heavier, the weight of the rifle being 10 lbs. 8 ozs., and the brass-handled sword-bayonet 1 lb. 10 ozs. additional, without scabbard.

The tests applied by the Washington Board to the arms before them were:—

1st. That for safety each gun should be fired ten rounds by the exhibitor, if present, or else with a lanyard; then with 3 cartridges purposely made defective, and the escape of gas at the breech registered by putting a fresh piece of paper over the breech at each discharge.

2nd. How many shots fired in one minute would strike a target 6 × 2 feet at 100 feet distance.

3rd. The number of shots which can be fired in one minute irrespective of accuracy.

4th. Endurance. 500 continuous rounds without cleaning.

5th. Dust. The mechanism to be exposed to a fine sand blast for

<sup>1</sup> "Nach dem Obigen kann nun wohl angenommen werden dass die Zukunft den Blockverschlüssen gehoört, und die Cylinder-verschlüsse, das sie von jenen ueberflügelt sind, als veraltet und nicht mehr zeitgemäes anzusehen sind. Zu diesen gehoört aber auch das Mauser-System, welches im Uebringen allerdings wohl die Vollkommenste Construction dieser Gattung ist."

two minutes; removed; fired 20 rounds: sanded again for two minutes, and then fired 20 rounds more.

6th. Rust. The breech mechanism to be cleaned from grease. The barrel greased and plugged, and the butt of the gun immersed to the height of the chamber in salt water or solution of sal-ammoniac for ten minutes, exposed to the open air for two days, and then fired 20 rounds.

7th. Excessive charges. To be fired once with 85 grains of powder and 450 grains of lead, and once with 90 grains and 450 lead, and once with 90 grains and 900 grains of lead.

One very fair provision was, that any cartridge missing fire should be tested, to ascertain the cause of failure, whether in the gun or ammunition; and it will be noticed that the first of the excessive charges used as a test is actually lighter than the service charge of the Martini. The arms which survived these preliminary tests were subjected to a further series of supplementary trials, as follows:—

1st. To be fired with two defective cartridges, then dusted five minutes. The mechanism being at half-cock then fired six shots, the last two with defective cartridges; then, without cleaning, to be dusted with the breech fully open, and fired four shots.

2nd. To be rusted for four days, after immersion, as before, and then fired five rounds with service cartridge; then, without cleaning, to be fired five rounds with 120 grains of powder and a ball weighing 1,200 grains; the gun then to stand twenty-four hours without cleaning, then to be thoroughly examined.

It is satisfactory to know that the Martini-Henry "came round the corner," and was one of those subjected to the supplementary tests with the following result:—

After the first exposure the arm worked stiffly. It pulled off very hard; the extraction was imperfect, the extractor only just starting the case out of the chamber.

The piece would not remain open after the lever was depressed, it was exposed a second time to the dust after which it opened very stiffly; one shot was fired, but in trying it afterwards it was found that the tumbler would follow up the motion of the block in closing.

By much working of the parts they performed their functions more properly, though moving stiffly meanwhile.

But after the second rusting test and exposure for four days, we find the guns opened and worked very stiffly, the tumbler invariably following the movements of the lever in closing. The piece was then dropped as disabled by the rust.

The Werndl, which had accompanied the Martini to this point, was also disabled, and was "dropped" by its side.

From the description, I should judge that this particular Martini rifle was disabled by the rusting of the trigger, or tumbler rest, overcoming the pressure of the trigger-spring, and holding these points permanently in the position of easing springs, as we find that the breech-block movement worked, though stiffly, to the last.

In the final series the guns were reduced to six, viz., the Elliot, Springfield, Remington, Freeman, Peabody, and one magazine musket,

the Ward-Burton, of which there is a drawing in section before you. This gun was also the only representative of the bolt system which had stood the tests, all the others being block guns, the Winchester, a very excellent magazine gun on the block system, having been disabled, like the Martini, by the second rust test.

It was then decided to issue a certain number of four systems, viz., the Remington, Springfield, Sharp's, and Ward-Burton, for trial, to the troops and await their report, when the preference was so markedly given to the Springfield, that the Board recommended that this system be adopted for the United States' Service. They added two other resolutions, that "the Elliot system had exhibited such remarkable facility of manipulation, in requiring but one hand to work it, that it is especially adapted to the mounted service, and recommended that a limited number of carbines on this system should be made and issued for trial. And further, since, in the opinion of the Board, the adoption of magazine guns for the military service by all nations is only a question of time; that whenever an arm shall be devised which shall be as effective as a single breech-loader, as the best of the existing single breech-loading arms, and at the same time possess a safe and easily manipulated magazine, every consideration of public policy will require its adoption." They added, that they had been so impressed by the merits of the Ward-Burton magazine carbine, as being the best of which they had any knowledge, that they suggested a small number should be made on this plan for trial.

But here a complication arose, which showed that even in the best regulated governments, difficulties will occasionally occur, for the Chief of Ordnance respectfully returns the report to the Secretary of War with this remark, that as the system recommended by the Board was to be "the only one" to be used in future, the law prohibits the manufacture of these two systems for experiment, that is, till the difficulty has been removed by the action of Congress.

The Elliot system, specially recommended for trial by the cavalry, is shown in section in the drawing before you, but I have not unfortunately an example of it, and its action is rather a peculiar one. It is a block action, having four movements, viz., opened, loaded, closed, and fired.

By cocking the hammer it operates as a lever on a stud attached to the breech-block, at each movement alternately pushing and pulling against the lower arm of it—so as to open and close the piece. After it is opened, the hammer falls forward, and resting on the projection prevents any motion of the block until the piece is closed, which is effected by again bringing the hammer to full cock, when it is caught by the trigger, and held ready to fire. When the trigger is pulled, the hammer-head strikes a firing pin, jointed in two sections, and explodes the cap. This action, and that of the Soper, are the only two I know which can be worked by the movements of the fingers and wrist of one hand without moving the fore-arm, and this is a great advantage in a cavalry weapon.

A very neat and handy cavalry carbine, with a sliding block movement, having the lock contained in and moving with the trigger-plate

and guard, has been kindly lent me to show you by Messrs. Deeley and Edge. Though not yet perfected, this is a very neat, handy, and compact weapon. It has only fourteen pieces in the breech mechanism, and of these but two are screws.

In the meantime a separate Board of Ordnance Officers had been sitting to determine the proper calibre for small arms as an appendix to the Report on breech-loading systems. Practically, their investigations were limited to determine whether the American service calibre of half-an-inch should be reduced, and if so, how much.

The calibre tried in these experiments were 50", 45", 42", and 40", and their decision, was, that the calibre of 45" was the best. It is curious to recollect that this is the precise calibre recommended by Sir Joseph Whitworth in 1857; that, in 1859, a Committee of Officers reported that it was too small for use as a military weapon; and then, in 1869, that another Committee reported, that this identical size was the most suitable for a military arm.

In the American experiments, the same European arms were tried in competition as were used by the Breech Action Committee, and it is satisfactory to read that "the only foreign system that shows "no deterioration of practice in 100 rounds is the Martini-Henry. "The worst is the Austrian Werndl, which goes completely wild after "sixty shots."

The barrel finally adopted has a bore of 45", three plain grooves, equal in width to bands, an uniform depth of 005"; twist uniform, 22", weight of barrel, 3 lbs. 9 oz., weight of gun, 9 lbs. 1½ oz.

The ammunition has a solid conical copper case, firing 70 grains of powder, and a hardened bullet of 405 grains weight. Total length, 2'6"; total weight, 604 grains. The Martini cartridge tried with it, and to which these remarks refer, had a total length of 3'15", and a weight of 767 grains.

In comparing them, the Committee made the following remarks after stating that at 500 yards—

The 45" Springfield, 70 grains of powder, 405 grains lead hardened penetrates 8' 8" into pine boards.

The 45" Martini-Henry, 85 grains of powder. 484 grains lead hardened penetrates 11' 2" at the same distance.

"It appears that the 45" (American gun) gives the greatest "penetration of any experimental system tried; the additional 2' 4" "of the Martini-Henry being gained by 15 grains more powder, and "80 grains more lead.

"The absolute practical recoil of an arm is difficult of determination. Reliable comparative recoils are however obtained by allowing the butt to rest against a coiled spring with a proper index.

The following were so obtained:

45" (Springfield) 123·6 pounds.

45" (Martini-Henry) 139·3 pounds.

"The Board was inclined to attach considerable importance to diminished recoil, deeming that refinements of action in other directions "are largely thrown away, if there is to be any flinching in the "soldier who pulls the trigger.



"In its view the additional 2.4" inches of penetration, at 500 yards of the Martini-Henry, is too dearly bought at 16 pounds increased recoil, leaving out of consideration the much heavier ammunition.

"Forty rounds of each of the following cartridges weigh—

    .45" Springfield, 3 lbs. 7 oz.

    .45" Martini-Henry, 4 lbs. 6 oz.

"Thus 51 rounds of the American ammunition could be carried at less weight than 40 rounds of the only foreign ammunition whose performance assimilates to it, viz., the Martini-Henry."

At the longest ranges, the results of five targets, at 500 yards, were :

	Springfield.		Martini-Henry.	
Mean.....	800 yards.	1,050 yards.	800 yards.	1,050 yards.
Absolute deviation .....	23' 3"	35' 2"	20' 5"	33' 7"
Angle of sight.....	2° 27' 16"	3° 34' 15"	2° 27' 38"	3° 26' 43"

With regard to the question of bottle-shaped cartridges as distinguished from straight or regularly conical ones, the Committee directed some experiments to ascertain the difference of pressure in communicating equal velocities.

They found that for every hundred feet of velocity impressed, the bottle-shaped chamber had to sustain a pressure of 1,402 lbs. per square inch, the pressure on the straight chamber being only 1,254 lbs., a difference of 148 lbs. Now, when the question of the recoil, which has been so much complained of in the Martini, is considered, we must not overlook how much of it is due to the peculiar shape of the cartridge. The base of the American cartridge is .5, that of the Martini nearly .6, and consequently the area from which the direct recoil is transmitted is so much larger.

So that everything in the Martini, shape of stock, construction of breech-bolt, and shape of cartridge, combines to increase the recoil, and the *Field* newspaper stated last month on "reliable information," that of these rifles already issued, from 5 to 7 per cent. are always in the hands of the armourer, chiefly from broken tumblers and springs. If there is any truth in these figures, it is high time the pattern was altered.

But, of course, a recoil to some extent must exist in all fire arms. What means have been contrived to lessen it? First, Mr. Murphy's plan, submitted by Captain O'Hea, which consists in removing the rifling from the seat of the shot to within about six inches of the muzzle, and shaping the junction of the so formed smooth bore with the rifling, according to the system which has been explained at this Institution by Captain O'Hea himself. This has undoubtedly given, in many instances, greatly diminished elevation and recoil, combined with increased accuracy; and it is certainly desirable that a more extended trial should be made of a system which has given such very promising results. In the only gun which the Government tried on



this principle, the gain in corrected elevation, after the alteration, was at 500 yards, 7' 55"; at 800 yards, 9' 0"; and at 1,000 yards, 11' 50".

Another plan which has been proposed to lessen the recoil, by Lt.-Col. Silver, of the Essex Volunteers, is to fit on to the butt end of stock a heel-plate of vulcanised rubber of varying degrees of hardness. This is undoubtedly most effectual in absorbing the recoil, and if it is found to have sufficient durability to stand the rough work of a campaign, we may look forward to see Sir Joseph Whitworth's anticipations realized, and be able to fire steel projectiles at 2,000 yards with 120 grains of powder. In a sporting express rifle I have fired 155 grains of powder ( $5\frac{1}{2}$  drachms) without any unpleasant recoil.

Amongst the arms presented to the Board at Washington, there were some specimens of an attempt to combine a spade—or rather trowel—to be used as an intrenching tool in place of the bayonet. These trowel bayonets, as they were termed, were at first laughed at as mere toys, the President of the Committee expressly states so in his report, but the first experiments tried with them, proved their value so fully that it was resolved to make a special report on the subject, and here are some of the results:—At the first trial, three men—labourers—in 4 minutes, 30 seconds, threw up an embankment 20 inches high, 30 inches wide at the base, and about 8 inches wide at the top, and  $5\frac{1}{2}$  feet long, which concealed them from observation at a distance of 10 yards when they lay down on the ground. The bayonet shank having been found inconvenient to hold, was fitted with a removable wooden handle, with which a better result was produced, a similar embankment having been thrown up in 4 minutes, and on a second trial in 2 minutes, 45 seconds. The President says, "I am satisfied that troops provided with it can completely shelter themselves from musketry fire in a few minutes. So shelter themselves, that with good breech-loading arms their position will be nearly impregnable."

The Colonel of Ordnance, who writes next, endorses the value of the trowel, but suggests that it should be carried separately, for fear it should injure the gun, which, as he justly observes, is the most valuable tool of the two.

The Colonel of Infantry follows the opinion of the Ordnance Officer, especially insisting that the present triangular bayonet shall be retained. The unanimous decision of the Committee is, that something of the kind shall be adopted, and ultimately it is resolved to issue for trial 10,000 of these trowel bayonets and an equal number of intrenching tools, to be carried separately and tested against them.

Whilst copying the resolutions I have just read you, only a few days ago, it occurred to me that if it were possible to combine a light steel scabbard for the bayonet, with the trowel fixed at the end of it, several of these objections, especially that of weight, would be considerably modified if not done away with, while the triangular bayonet would be retained in its full efficiency as the best thrusting weapon ever devised for troops. I have only had time to make up a very rough model of this idea, which I have here for your inspection, and

I think it is sufficient to prove that we may, by the addition of a steel trowel scabbard weighing less than 10 ounces, to the present bayonet, not only convert it into an efficient intrenching tool, but preserve its full value as a weapon. The trowel can be put on and drawn off in an instant. I have also had it fitted into a frog, that you may judge how far the appearance of the soldier's accoutrement is affected, and I think you will say—very little. The extra weight of trowel and frog, as compared with present bayonet scabbard and frog, is four ounces; and this would have, of course, to be saved in some way from the soldier's equipment, if the plan were adopted. As this contrivance has been made up in the greatest hurry, and indeed only completed an hour since, I must ask you to excuse the rough state of the pattern before you, which I hope you will think of sufficient interest to warrant my introducing it.

In concluding this rapid and imperfect survey of the state of breech-loading at the present time, I hope I have made clear, as I have endeavoured to do, how closely these three questions are dependent on each other, and I place them in the order of their importance.

1. The cartridge;
2. The barrel;
3. The breech action.

Having obtained a good cartridge, we may find half-a-dozen plans of rifling and a dozen plans of breech action, with which it will perform well. But the first question is—What do we really want? Sir Joseph Whitworth, whose reasoning is as exact as his mechanical workmanship, tells us that if we want great range, low trajectory, accuracy, and penetration, we must employ a long bullet, high rotation, and a large powder-charge. Every experiment for 16 years proves the truth of this opinion.

But in America we find a Committee of Officers, after a long course of experiments, decide upon a lighter bullet and less powder-charge, because of the saving of weight to the soldier. Now, shall we ever be able to make clear to ourselves what we really do want? or how to compensate these conflicting interests? Is the value of increased accuracy of shooting, at distances beyond 800 yards, worth an increase in the weight of the arm and ammunition? When we watch the marvellous shooting for the Elcho Shield at Wimbledon—when the same man will drop bullet after bullet within the space of a man's hand, at 1,000 yards, we see what can be done by the best marksmen, with the best weapons; but, at this very Wimbledon meeting, what will be the average shooting, with these same weapons, through the whole meeting? Why, at 800 yards, only one out of six shots will hit within a circle of 20 inches in diameter, and in all probability, in the field, this would not even be approached.

When we have decided upon the best cartridge, which, as we have seen, depends upon the distance we want it to shoot, it will be worth while to consider whether it is absolutely necessary that we should have only one form of breech action for the service, and whether the peculiar exigencies of the infantry, cavalry, navy, and artillery might not be easily consulted by a modification of the arm, providing that

the same bore and cartridge were employed, but, if necessary, with varying lengths of powder-charge and bullet.

Lest it be objected that I criticise much and suggest nothing definite, I will give a slight sketch of what are the principles which I think should guide us in selecting a military breech-loading small arm. For the barrel, let us take that which shall make the best aggregate shooting at 300, 600, and 900 yards, and we shall have a weapon which will give all the accuracy that the average human eyesight can employ; the weight of gun not to exceed 9 lbs, without bayonet, which is the utmost that can be handled or carried with comfort, the lightest cartridge which will stand knocking about, and throw a bullet of 450 to 480 grains. For the breech action, let us choose that which is most easily repaired by a half-skilled workman in a hurry, and away from any manufacturing resources or machinery, as, for instance, on the road to Coomassie.

Let us have a triangular straight bayonet, and if we can, combine with it a light intrenching tool, under three-quarters of a pound in weight, like that I have shown you; it will be most serviceable. Let the sergeants and corporals carry a sword-bayonet, like the Elcho, which combines a bill-hook, hatchet, and saw, instead of the straight bayonet and trowel.

I can only say that no one will be more pleased than myself to see every one of these suggestions contradicted, criticised, and discussed, until each is replaced by something better; but I cannot help thinking that in England lately we are trusting too much to mechanicians and manufacturers upon points which require the special knowledge of a soldier to decide. Only let those who can speak from experience clearly define what is really wanted in a military weapon, and then we may safely rely on the manufacturing skill of England to give us the best realization of their wishes.

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*Comparative Weights of Service Musket, with 40 rounds of Ammunition.*

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	Rifle.	Cartridges.	Total.
	lbs. ozs.	lbs. ozs.	lbs. ozs.
<i>English.</i> Martini Henry.....	8 12	4 6	13 2
<i>American.</i> Springfield.....	9 1½	3 7	12 8½
<i>Russian.</i> Berdan.....	9 2	3 7	12 9
<i>Austrian.</i> Werndl.....	9 11	2 14	12 9
<i>Swiss.</i> Vetterlin.....	10 0	2 10	12 10
<i>Prussian.</i> Mauser.....	10 8	3 2	13 10

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## TABLE OF BREECH-LOADING SYSTEMS, 1874.

The figures following the name show the number of motions necessary to load and fire one charge; starting with the breech-action closed, and hammer down.

CHAMBER LOADERS. *Obsolete.*TAP, OR CROSS BOLT. *Obsolete.*

Jouband, 6.	Leetch, 6.	Perry, 5.
Harrison, 6.	North, 6.	Mathews, 5.
Needham, 6.	Lechmere, 5.	Leetch, 5.
Rutley, 4.	Mont Storm, 6.	

*Plug or Cone*—"BOLT ACTION"—having the Lock mechanism,

Contained.		External.	
<i>s.</i> Sears, 6.	American, 4.	Prince, sliding barrel, 6.	Reeves, 6.
<i>s.</i> Prussian, 6.	<i>s.</i> Needham, 4.	Wilson, 6.	W. Richards, 6.
<i>s.</i> Wilson, 4.	<i>s.</i> Dreyse impd. 4.	Terry, 6.	Carr, 6.
<i>s.</i> Burton, 4.	<i>s.</i> Chassepôt, 5.	Burton, 6.	Cooper, 6.
Millar, 4.	<i>s.</i> Mauser, 4.	Green, 6.	Kerr, 5.
Carter Edwards, 4.			

*s.* Signifies "spiral main-spring."

## BLOCK OR WEDGE ACTION, viz.—

<i>Falling Block.</i>	<i>Sliding Block.</i>	<i>Segment Block.</i>
Allen & Weelock, 5.	Sharp, 5.	Perry, 6.
Peabody, 5.	Henry, 1867, 5.	Remington, 5.
Roberts, 5.	Westley Richards, 4.	Comblain, 4.
Elliott, 4.	Ballard, 5.	
Werder, 4.	Cochran, 6.	
Westley Richards, 4.	Henry, 1874, 4.	
Martini, 4.	Deeley, 4.	
Tranter, 4.		
Swinburn, 4.		
Zeller, 4.		

*Hinged Block, turning on an axis at the*

SIDE,	UNDER, or	OVER the barrel.
Snider, 6.	Krutsch, 4.	Braendlin, 5.
— Hunt, 5.	Wernld, 5.	Fosbery, 5.
Soper, 4.		Berdan, 5.
Needham, 5.		Springfield, 5.
Joslyn, 5.		Waenzl, 5.
Newark, 6.		Selwyn, 5.

MAGAZINE GUNS	Unknown (A.D. 1666).	
	Ball & Lamson.	Scott.
	Spencer.	Selwyn.
	Henry.	Vetterlin.
	Ward Burton.	Winchester.

## PROPOSED ALTERATIONS IN THE MARTINI-HENRY RIFLE.

By Dr. L. O. THAYER, M.D.

By the kind permission of the Council of this Institution, I am enabled this evening to bring to your notice what I think to be improvements in the "Martini-Henry" rifle, and I will now proceed to name them in detail, trusting that their simplicity will meet with your approval.



As you perceive, I have removed the spiral spring, and the two bolt-screws necessary to hold the spiral spring in its position in the breech-block, and have removed sufficient of the under surface of the breech-block to admit of the free exit and entrance of the needle or striker. This latter I attach to the head of the tumbler by a small screw, and cut away a sufficient portion of the back of the tumbler, at its lower third, to form a catch for the spring.

The spring is a flat or ribbon spring, bent to a V-shape, placed upright, one end in a slot or niche in the body of the shoe, the other end free and engaging the tumbler, driving it strongly forward when the trigger is pulled, and carrying the needle against the cartridge.

The alterations required in the Martini to admit my improvements are so slight that the expense incurred would be more than counter-balanced by the diminution of parts, and by the gain in time required to take the action to pieces for repairs and cleaning.

The item of repairs alone would justify the adoption by Government of my adaptation, as it is almost impossible for my action to go wrong, or break, from the force of the spring being so applied as that its whole power may be exerted without detriment to any part, or necessitating double pieces, as in the trigger and trigger-rest in the present arm.

The mainspring being flat and loose is not easily broken, pressure is always even, and I feel sure that the tumblers, needles, and spiral springs, now so often found broken in the Martini, will be entirely done away with, and the great expense to Government for repairs to disabled guns and in wages to skilled workmen, dispensed with.

By the use of a flat mainspring, regularity in the pull off is also gained, and any required weight can be placed on the trigger. With the spiral spring this is an impossibility, as was shown at Wimbledon

last year, where the pull off ranged from two to twenty pounds by a slow or quick descent of the lever in ejecting the cartridge.

As to the grasp also, the thumb-rest is rendered unnecessary, as by doing away with the sear-rest, the trigger is brought nearer the shoulder, and the soldier's hand can get well round the gun, and is not kept in an extended position as now.

The cost of a flat mainspring like mine is about the same as that of the spiral spring, and its advantages are so much greater that in my opinion it ought to be at once applied.

This is done so easily that no alteration to the present machinery in use would be needed, which would not be the case if other systems were to be used, as the Westley Richards, Swinburn, Tranter, &c. I have also to add that in lieu of the indicator (which at night, by the way, is no indicator), I substitute a short lever, serving by its length as a rest for the soldier to support arms, when on sentry duty, and also as a safety or half-cocking apparatus, by which he can uncock or cock his rifle without danger, or as now, being obliged to depress his lever and throw out the cartridge, with the risk of losing it in the dark or in the woods. His Royal Highness the Duke of Cambridge has been pleased to express his approbation of my proposed alterations.

It seems very necessary that the soldier should be armed with a weapon on which, from its strength and durability, he can rely, and one which in time of need he can clean, repair, or replace the broken parts of, himself. A spare needle or spring could be easily carried in his knapsack. All the tools requisite for my improved rifle are, a small file and a screwdriver, the file to make a needle from a nail, if necessary, and the screwdriver to take the mechanism out, to clean or to repair it.

These are a few of the advantages to be derived from the improvements now brought before your notice, and I trust that they may be thoroughly tested, and their value proved.

I thank you, Mr. Chairman and Gentlemen, for your kind attention, and shall be happy to answer any questions on this subject.

The CHAIRMAN : There is no half-cock?

Dr. THAYER : No half-cock, it is the same as in the Martini, and no trigger-rest is required, as the action is direct in the rear, consequently you do away with the pieces that are required in the Martini.

I also wish to show a bolt gun, which I think does away with the main objection to the use of the bolt, viz., the danger of the gun going off when the bolt is in this position, which sometimes happens in the Chassepôt and other guns made on this principle. My improvement is the introduction of a cam, so that the needle cannot strike the cap, and the gun cannot go off until the bolt is right over. This gun only contains 13 pieces including screws, viz., five screws and eight pieces. By removing two screws, the whole action is seen. I saw a gentleman in Paris firing a Chassepôt recently, and the bolt flew backwards, removing the whole of the side of his cheek.

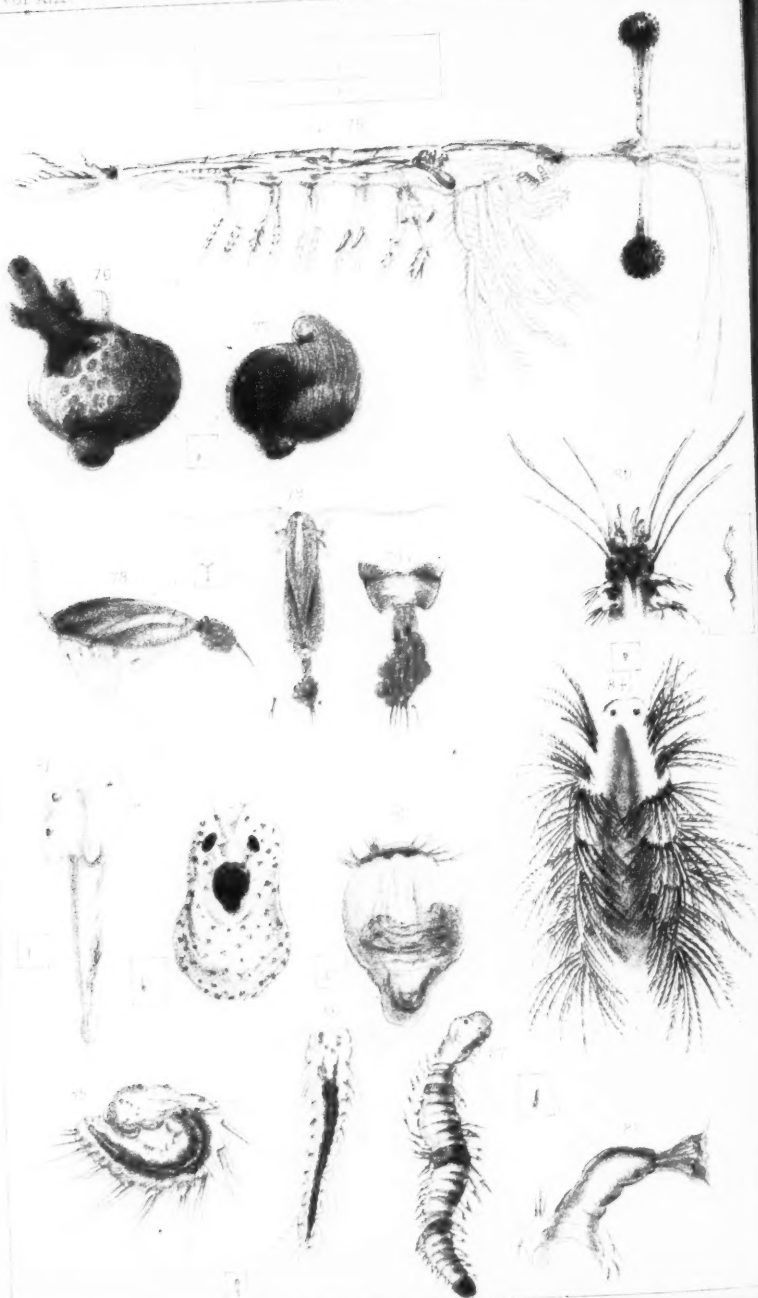
The CHAIRMAN : As no gentleman rises to make any observations, I wish to say a few words before giving that which I am sure will meet with your entire concurrence, our hearty thanks to Mr. Latham for his most interesting paper. I do not know that I have ever listened to any statement of the kind which has been more interesting, more intelligent, or has contained a larger amount of useful information than the paper which we have heard read this evening. In his criticisms and comments on the various forms of breech-action, Mr. Latham has not flinched

from saying what he thought the merits or defects of each, but he has done it in that language which will make it acceptable, I believe, even to those who see the error of what they considered to be the acme of perfection. There are several points, in fact, there are so many points in this most interesting paper which, if all were touched upon, would occupy very much more time than is necessary or desirable to give to the subject now, but there are one or two points which I think we may very safely accept as the result of what we have heard this evening. The first is that one of the great defects of the rifle which has been introduced into our army is that it is not possible to cock and half cock it. To me that has been from the first, the very greatest defect that the mechanism of the rifle possesses. Another point which I consider unnecessarily elaborate, is the rifling. Mr. Henry's rifling has obtained great celebrity in England, and it is I believe, made the model now by gun-makers who used formerly to apply different systems. But we see the Americans steadily sticking to the old form of three-groove grooves, and in the face of all that they have seen and proved by experiments, they still adhere to that form of grooving instead of adopting that which we consider to be so excellent; and the shooting of their rifle is really, for military purposes, quite as good as that of our own. Now I am of opinion that the great surface of friction in the Henry form of grooving, is one of the causes of the heating of the barrel. The high pitch of twist is undoubtedly one of the causes of recoil, and the very great surface produced by this system of rifling gives such a large surface for the bullet to rub against, that the barrel heats unnecessarily. Not to enter into detail, I think our Government or any Committee which may be appointed to improve the military arm (and that it does require improvement there is to my apprehension the most undeniable evidence), will find in this admirable paper which Mr. Latham has read to-night, matter which will furnish them with sufficient information on every point as far as I understand it, to enable them to design and bring out a rifle—even if they adhere to the drop block principle—which will be as nearly perfect as it is possible for any machine to be. The form of the cartridge requires modification unquestionably, and the form of breech-action I think requires modification. There are several patterns; I believe a Swiss pattern, the Zeller, appears to possess all the requirements of a drop-breech action, but I must say (and I adhere to it) that with all that has been said against the bolt principle, I still feel that principle to be the handiest; and handiness will in future be one of the greatest requirements of a good rifle. When a soldier is behind a shelter-trench, it will be impossible for him to manipulate well, when he is obliged to lift his body and to move his arm *in extenso* (as he is in all those systems which are moved by a lever underneath), *i.e.*, he cannot be as effective or as well concealed as he would be while using the Soper or the Green, or any of those systems where he can do all that is required by the mechanism of the wrist. I have never deviated from my opinion as to Mr. Green's rifle, which has this one excellence, that you cannot strike the cartridge with the bolt. When the bolt is pushed home as far as you can push it in a straight direction, there is still an eighth of an inch between the front surface and the base of the cartridge. The closing of the breech in Green's breech-loader I consider as safe as it is in any other form of weapon.

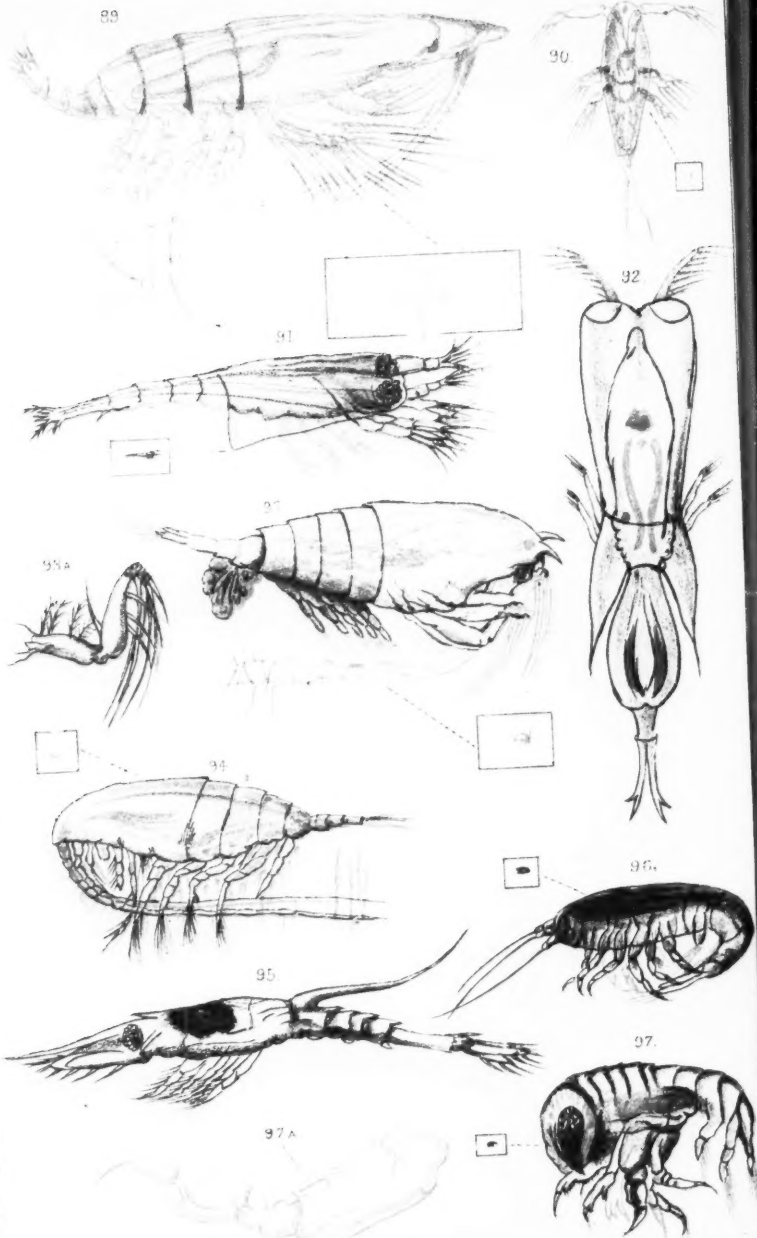
And with these remarks I think I may ask you to give our warmest thanks to Mr. Latham for the very admirable paper which he has read to us. I may also be allowed to thank Dr. Thayer for his kindness in exhibiting these his most interesting improvements in the mechanism of rifles.













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Fig.

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DELINEATIONS OF SOME MINUTE SEA-SURFACE  
ANIMALS.—From Coloured Drawings by Mrs. TOYNBEE.

PART IV.

(Concluding the Series.)

(Continued from page 531.)

For instructions regarding means of capture, examination, &c., see  
page 214.

PLATE VII.

Fig. 75. *Crustacea Stomapoda. Male Lucifer.*—

- „ 76 and 77. July 10th, 1858. Lat., 34.58 N.; long., 38.17 W. Current, S. 70° E., 9 miles. Temperature of surface water, 74°.
- „ 78, 79 and 79A. Nov. 25th, *Crustacea*. Lat., 10.14 S.; long., 79.58 E. Temperature of surface water, 79°. Pumped up this crustacean, having ova attached to its tail, the hairs at the end of which were like miniature feathers.
- „ 80. *Annelid*.—May 21st, 1857. Lat., 30.27 N.; long., 45.16 W. Current, N. 41° W., 5 miles. Temperature of surface water, 73.9°. This Annelid was found amongst the Sargassum. Its head was peculiar, but its general appearance and the divisions of its body similar to one previously found on January 7th, 1857.
- „ 81. *Pteropod larva?*—May 13th, 1858. Lat., 35.03 S.; long., 21.41 E. Current, N. 30° E., 31 miles. Temperature of surface water, 65°. Found many of these Pteropods with actively moving ciliæ.
- „ 82. May 3rd, 1858. Lat., 29.57 S.; long., 38.35 E. Current, S. 76° E., 26½ miles. Temperature of surface water, 72°. Found this creature which seemed to have an outer mantle, the contractions of which were the only signs of life.
- „ 83. *Medusa*.—Feb. 2nd, 1858. Lat., 15.33 N.; long., 81.20 E. Current, N. 17° W., 4 miles. Temperature of surface water, 78.7°. Found this Medusa, which contracted and expanded its flexible mouth continually, on the edge of which bunches of hairs were distinctly visible.
- „ 84. *Annelid*.—Feb. 2nd, 1858. Lat., 15.33 N.; long., 81.20 E. Current, N. 17° W., 4 miles. Temperature of surface water, 78.7°. This strange little animal had no apparent motion.
- „ 85 and 86. *Larval Annelid*.—Oct. 23rd, 1857. Lat., 17.57 S.; long., 37.07 W. Current, S. 2° E., 22 miles. Temperature of surface water, 76°. Found this Nereis? which had apparently ciliary motion, both about its head and tail; its long hairs were generally lying along its body when it moved.
- „ 87 and 88. *Annelid Nereis*.—Jan. 7th, 1858? Lat., 14.29 N.; long., 82.32 E. Temperature of surface water, 78°. This creature moved through the water like an eel, wriggling its body rapidly and using its hairy fins as propellers; it became entangled in some Canada balsam and paper on the slip of glass on which it was placed, and, when it disengaged itself, had the singular projection from its mouth shown in Fig. 88.



## PLATE VIII.

- Fig. 89. April 6th, 1857. Lat., 34.18 S.; long., 25.31 E. Current, S. 49° W., 37 miles. Temperature of surface water, 65°. Towed the net, and caught this crustacean, remarkable for the length of its horn and paddles, or fins, with which it kept up a constant motion in the water. No eye was visible, unless the dark spot over the horns was one.
- „ 90. *Larva*.—March 9th, 1857. Lat., 7.35 S.; long., 84.11 E. Current, N. 45° E., 17 miles. Temperature of surface water, 80.4°. This small, transparent crustacean is singular in the shape of its tail, part of which has, probably, been lost.
- „ 91. *Larval Crustacean*.—April 8th, 1857. Lat., 34.53 S.; long., 22.38 E. Current, S. 77° W., 15 miles. Temperature of surface water, 64°. Towed the net and found great numbers of these larval crustaceans? The three legs were in such rapid motion that it was difficult to make them out distinctly.
- „ 92. *New Copepod or a Larva*.—25th Nov., 1856. Lat., 10.14 S.; long., 79.58 E. Temperature of surface water, 79.9°. This crustacean had very large and clearly defined eyes.
- „ 93 and 93A. *Euchæta Communis (diadema?)*.—May 9th, 1857. Lat., 3.49 N.; long., 28.02 W. Current, N. 50° W., 30 miles. Temperature of surface water, 79°. Nearly calm; towed the net, and found two specimens of *Euchæta communis* (*diadema?*) having eggs attached to their tails. The turquoise blue of the eggs was in remarkable contrast to the transparent red and white of the body. They differed from others we have found in having the eggs placed in one plane, and not in a bunch. 93A, one of the fore claws enlarged.
- „ 94. *Copepod, probably Pontia or Cyclops*.—Nov. 5th, 1856. Lat., 39.43 S.; long., 53.29 E. Temperature of surface water, 54.4°. This insect was pumped up from the sea by a pump, the suction-pipe of which was about seven feet under water. It was very active. With a high power, quick vibration was visible along the back, though no cilæ could be distinguished.
- „ 95. *Larval Crustacean Macroura*.—March 6th, 1857. Lat., 0.57 S.; long., 82.50 E. Temperature of surface water, 82°. Towed the net and caught this crustacean. The horn projecting backwards is remarkable; the eyes were very prominent.
- „ 96. *Young Amphipod*.—March 6th, 1857. Lat., 0.57 S.; long., 82.49 E. Current, N. 30° E., 25 miles. Temperature of surface water, 81°. This small crustacean jerked through the water by drawing up its tail towards its head; the hind feet were kept in such rapid motion that it was difficult to make out more than that they were hairy, unlike the claws of the front part of the body, which were free from hairs.
- „ 97 and 97A. *Crustacea, Amphipoda, Phrasina?*—March 27th, 1857. Lat., 28.24 S.; long., 48.49 E. Current, N. 56° E., 5 miles. Temperature of surface water, 73.3°. This creature was caught in the net. It generally remained quietly at the bottom of the tumbler, but at times it started up and performed several summersaults in the water. It appeared to have a black patch on each side of its head. May 22nd, caught one of the above of a bright lilac colour; it frequently rolled itself up into a round ball. 97A, is an enlarged view of the most prominent of the fore legs.

## **Ebening Meeting.**

Wednesday, May 5th, 1875.

MAJOR-GENERAL T. B. COLLINSON, R.E., in the Chair.

### **ON THE PROPOSED ENCLOSURE OF DOVER BAY.— REVIEW OF DESIGNS AND HISTORICAL ESSAY ON THE HARBOUR.**

By JOHN BALDRY REDMAN, F.R.G.S., M.I.C.E., &c.

THE interest attached to this subject, and its national importance, are best shown by a short reference to the early advocacy of such a measure. The first complete design being that of the reign of Henry VIII. The smaller area of enclosure, viz., about 150 acres shown in the diagram of the various enclosure designs, and such a measure was advocated by the great Sir Walter Raleigh even in his day. This plan is interesting, as fully recognizing the laws which govern the movement of the southern belt of shingle, as having a determinate leeward movement eastward up channel, shown by the two projecting groynes from the west pier, designed to arrest it, to form a protecting slope and keep open the harbour's mouth.

Dover as a military station attracted attention from the days of Cæsar, whose description assigned to this port, and the numerous works of the Romans, all testify to its importance. Henry VII erected a round tower on the western side of the harbour, with moorings; and during the subsequent reign a new west pier was erected, but the shingle soon blocked up the entrance. This frequently occurred, and the harbour was inaccessible to vessels for years continuously.

Harris, in his history of Dover, records that Henry VIII expended about £80,000 in improving the harbour, and Henry the Eighth's west pier was completed by Elizabeth in 1585, but not to the full length of the foundation laid by Henry VIII, called the "Mole Head," and which was cut through by the present pier in modern times. The great blocks of stone for this early work, of twenty tons each, were brought from Folkestone on frames of timber floated on empty casks, and the chalk stones for filling-in were brought from the north-east side, in a great boat, called "Gaboth," which had nine keels. The king encouraged this work, personally viewing its progress, and giving £50,000 towards it, but at his death it went to decay, and in Queen Mary's reign an attempt was made to carry it on, which failed for want of funds. The beach drove quite through the piles and choked the harbour, making a shelf from thence easterly to the bottom of the cliff called "Castle Ray," the river forming an uncertain outlet assisted by manual labour. These causes, and the loss of Calais about the same period brought Dover into decay, lapsing into the condition of a mere shingle haven, like other small ports along our south-eastern shores. This shelf became subsequently an effectual

barrier; and a stone wall was partly built in Elizabeth's reign from the Water Gate, where the river ran into the sea, to the "Block Bulwark" on Henry the Eighth's Pier, 1,100 yards in length, and if completed would have cost £100,000. The surveyor to this work, John True disgraced his name, and was not faithful, and was succeeded by one Ferdinand Poins from the Low Countries, who had been engaged in repairing breaches in the Thames embankments at Erith and Woolwich, who undertook to make certain "knocks" or groynes, and a wall from the Water Gate to "Castle Ray," about 660 yards in length, on the eastern side of the harbour frontage; and another wall at right angles landward to the cliff, 220 yards in length. Great discussion ensued as to how those walls were to be formed. Poins proposed oaze and beach; local shipwrights, wooden walls; Sir Thomas Scott, "arming," as at Dymchurch wall, Romney Marsh, and men from that locality were eventually employed, under a Treasury Expenditor and Surveyor. The work was begun May, 1583, walls of earth, chalk in the middle, sleet on the outside lined with faggots; in three months the whole "perimeter" or inclosure of the harbour was finished, and had no leaks, and continued so for three years, and then at quarter flood a ship of 50 tons could enter, and at high water 300 tons, and two jetty heads were finished, "perfecting" the mouth of the harbour.

Those works amounted to £2,700. Sluices were also then formed: the first small sluice in the cross wall being taken up and superseded by one 80 feet long, 16 feet broad, and 13 feet deep, with two gates, and which took a "whole month in laying." "The good Lord" Cobham staid there all the time, and kept a table to encourage the "workmen."

James I appointed a Commission to supervise those works, and by the charter of this monarch, 1606, the back of the pier or harbour ground was granted to the Warden and Assistants of Dover Harbour.

Much interesting light is thrown upon the condition of Dover Harbour at an early period by the drawings in the Cotton Collection of the British Museum, principally referring to the reigns of Henry VIII and Elizabeth, showing that the harbour was formed by the flow and reflux of the tidal waters through the beach, cast up across the inner side of the bay by the waves from south-west, with three main channels in the direction of the inner pent. Arch Cliff to the west is described as a cliff with bulwark and groyne at foot, and thence to the south pier a castellated wall, with guns backed by a stone slope, and terminated next the pier by a stone bulwark mounting guns, with loose stones thrown at the foot; from this a timber groyne or pier projected in a south-westerly direction, apparently to arrest the beach and from the stone bulwark a south pier, convex outwards, covers the entrance from the south-west, with guns mounted at the head, and loose stones, thrown down at the foot; the north pier, of a crescent form, curving outwards, of timber, with a pole and lanthorn at the head, is considerably overlapped by the south pier; a large amount of beach is shown fronting the bay and surrounding the Haven waters. The importance attached to the military defence of these works is shown

by these early documents. During the reign of Elizabeth, the harbour assumed somewhat its modern form, with the inner pent and outer pent and the outer harbour, called by the mariners of that day "Paradise," and there appear to have been two groynes between Archcliff and the "Block Bulwark" of Henry VIII, which stood near Cheeseman's Head, which was incorporated in the root of the present Admiralty Pier.

From the head of Queen Elizabeth's south pier, and in the same line, ran the foundation of Henry the Eighth's, in a straight line easterly for 660 feet, terminating in the "Moule Head."

Various groynes were situate on the north side of the harbour. The last, called the North Groyne, approximated in position with the north end of the great pent or inner harbour, and the distances from Archcliff Fort and Cheeseman's Head to the north end of the Great Pent, measured from those old plans, exactly accord with those taken from modern surveys: and these documents are interesting, showing as they do how parallel were the circumstances of the harbour at that remote period to those now existing, and that points had been rendered permanent by works of art and the general outline preserved to the present day, modifications of form having been brought about by the extension of former and by the addition of modern works.

The plans of Elizabeth also show that the shore was then protected by numerous groynes forming sudden projections and deep recessions. A plan of 1595 shows that the "Block Bulwark" had gone to decay; that a new north pier was contemplated that year; there was then a "*Beacon on the Moule Head*," and on it we find the extent of Henry the Eighth's foundations, justifying the praises of old writers; from 200 to 300 feet seaward of any modern works prior to the erection of the Admiralty Pier of the present day.

Leland, Camden, Stow, Burton, Sumner, Stukeley, all describe the town and harbour; and Camden has the following truthful and noteworthy passage:—

"The town lying among the cliffs where the harbour antiently was (when the sea came up thither, as may be inferred from the anchors and planks dug up there), &c."

And again:—

"On the side next the sea, now shut out by a gravelly beach, it was surrounded by walls, of which some part still remains."

Stukeley also contains the following graphic passage:—

"If we consider the antient state of Dover, we must imagine that the little river ran directly into the sea and left a harbour close to the walls of the town; but in process of time, as the sea threw up that vast beach which lys between the town and it, the river was forced by an oblique passage to creep along the shore under the Southern Cliff and there vent itself where now is the harbour."

In 1652, it appears there was a depth of 22 feet at high-water springs, the piers and jetties were subsequently erected to make permanent what had hitherto been a fluctuating passage through the shingle.

Lyon in his history of Dover, says:—

"There are no records remaining to point out the time, when the depth of the stream was so much diminished, as not to admit vessels

"into the valley, but it is certain that, as early as Edward the Confessor, the mariners were obliged to seek shelter for their boats on the eastern side of the Bay, and they continued to use that place as a harbour for many years; for when William I fortified the town with a wall and towers, the harbour was at the foot of the hill, near the wine vaults, where the low ground still appears, and was used for many years as a farm yard, a garden, and for other purposes."

Captain Perry, well known by his memorable work to stop Dagenham breach on the Thames, visited Dover in August, 1718, under the auspices of Lord Aylmer, and he referred in his report to the surveys and "endeavours," from the "great Sir Walter Rawleigh," until his view to render the port available to large ships. He recommended low-built groynes along the beach margin on each side of the harbour, down to low water along the frontage of the town and an extension of the West Pier.

Captain Perry's report concludes thus:—

"There is more riches frequently lost in one storm by merchant ships being driven from their anchors in the Downes, than would make this a common place of safety for a very considerable number of such ships. And your Lordship can best judge how great an expense would be saved, and what advantage would accrue in time of war, by making this a port convenient for cruising ships."

Smeaton reported on the harbour in June, 1769, and referred to the importance attached to it as a national object from a remote period, to the changes it had undergone and the manner in which it had for years been blocked up with shingle, he discouraged groynes, the necessity for which he said would be "*eternal*;" he referred to the danger the Pent wall was in formerly from a breach, until a fall of the Castle Cliff arrested the beach, made more permanent by the subsequent erection of the "Castle Jetty," and consequent accumulation of shingle, also to the erection of "Cheeseman's Head," and to the diminution of its effect in arresting beach, consequent (he said) on its decay.

Smeaton, like Perry, proposed an elongation of the West Pier, and certain improvements in the sluices.

Telford, during the winter 1833—34, was called in by the late Duke of Wellington, then Lord Warden of the Cinque Ports, and Chairman of the Harbour Trust, to report, consequent upon the continued increase of shingle and blocking up of the harbour, who advised and partly carried out the extension of the sluicing power from the Inner Harbour to a reservoir and sluices in the South Pier Head extended and a low water external apron therefrom.

At his death these works were completed, together with extensive improvements of the Pent and Inner Harbour, by the late James Walker, Past President Institution C.E., who also subsequently carried out the Admiralty Pier, now under the charge of Mr. Druce, who for many years was resident engineer.

The report of the Commissioners on Harbours of the south-east coast, describes the then condition of the works, and suggests that their extension and improvement, and an elongation of "Cheeseman's Head," are all "*most desirable*."

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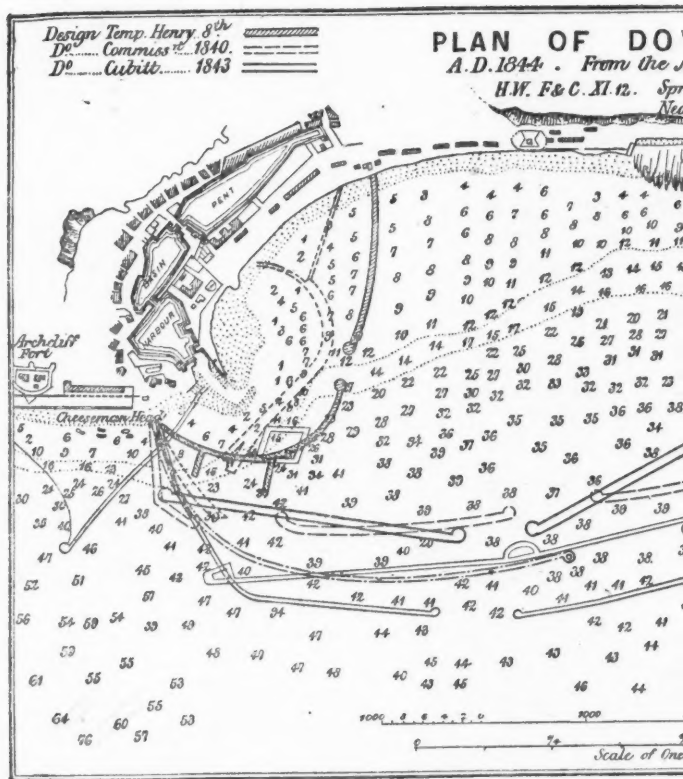
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# OF DOVER BAY

From the Admiralty Survey.

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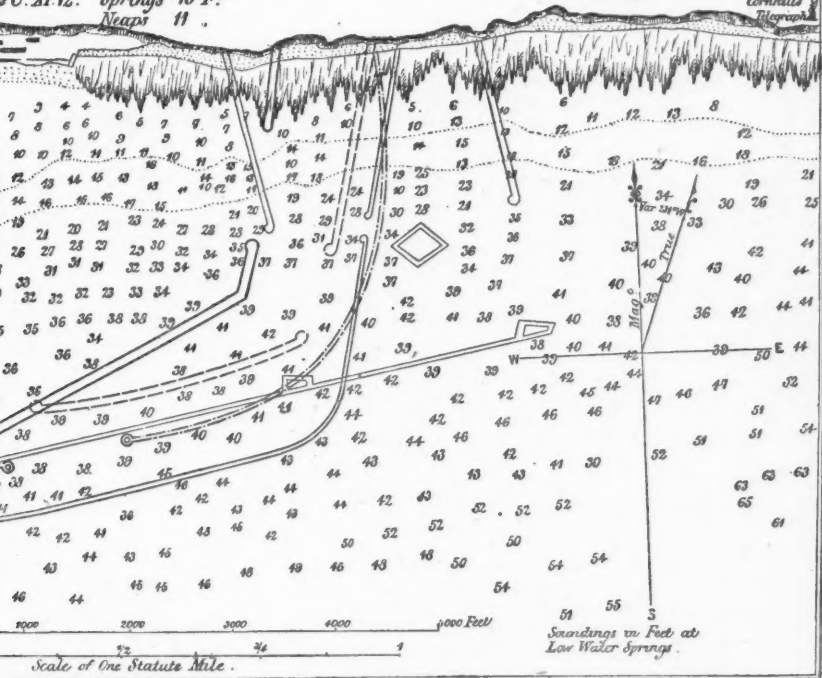
Design. Steward.....1843.

D<sup>o</sup>.....Commiss<sup>r</sup> 1844.

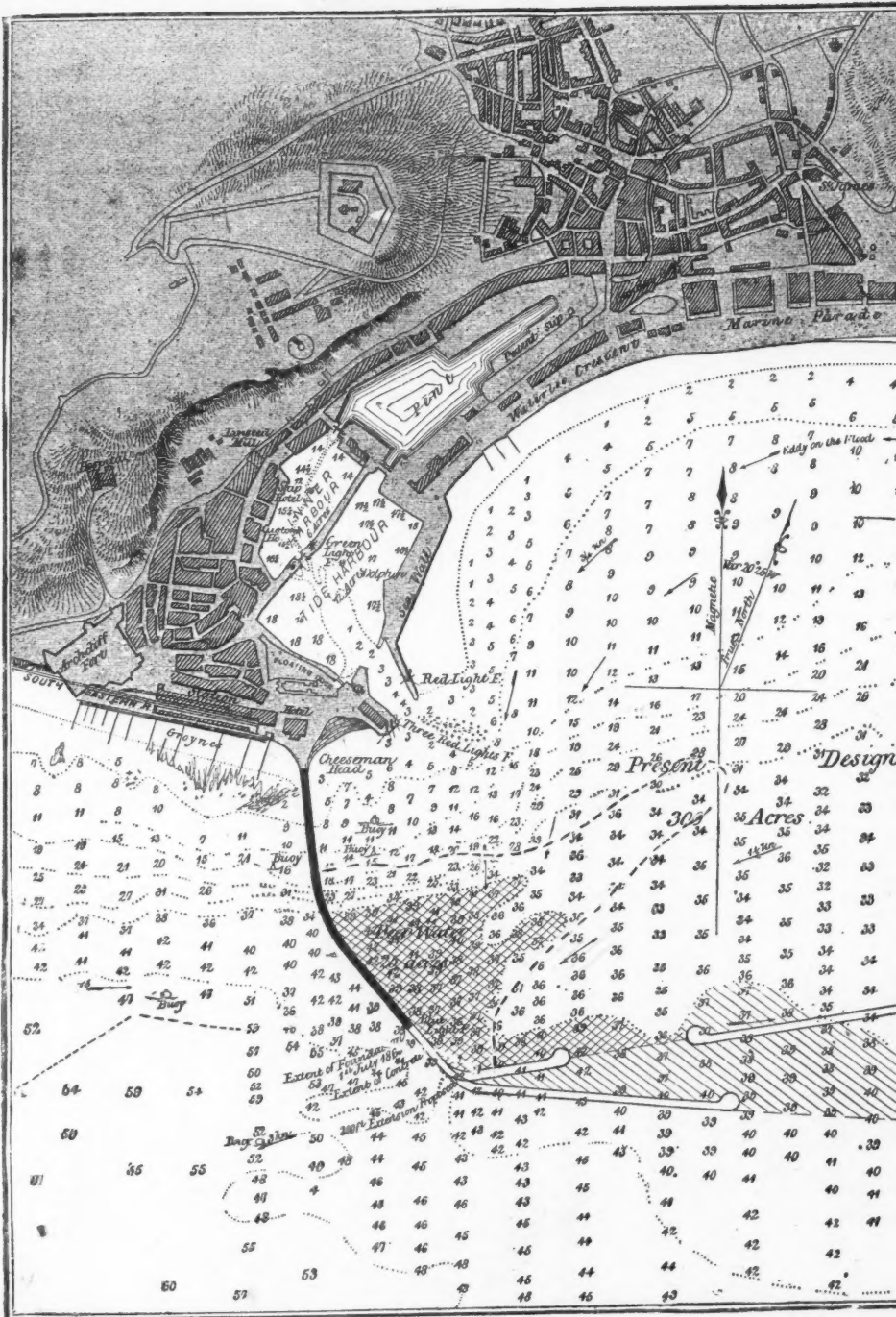
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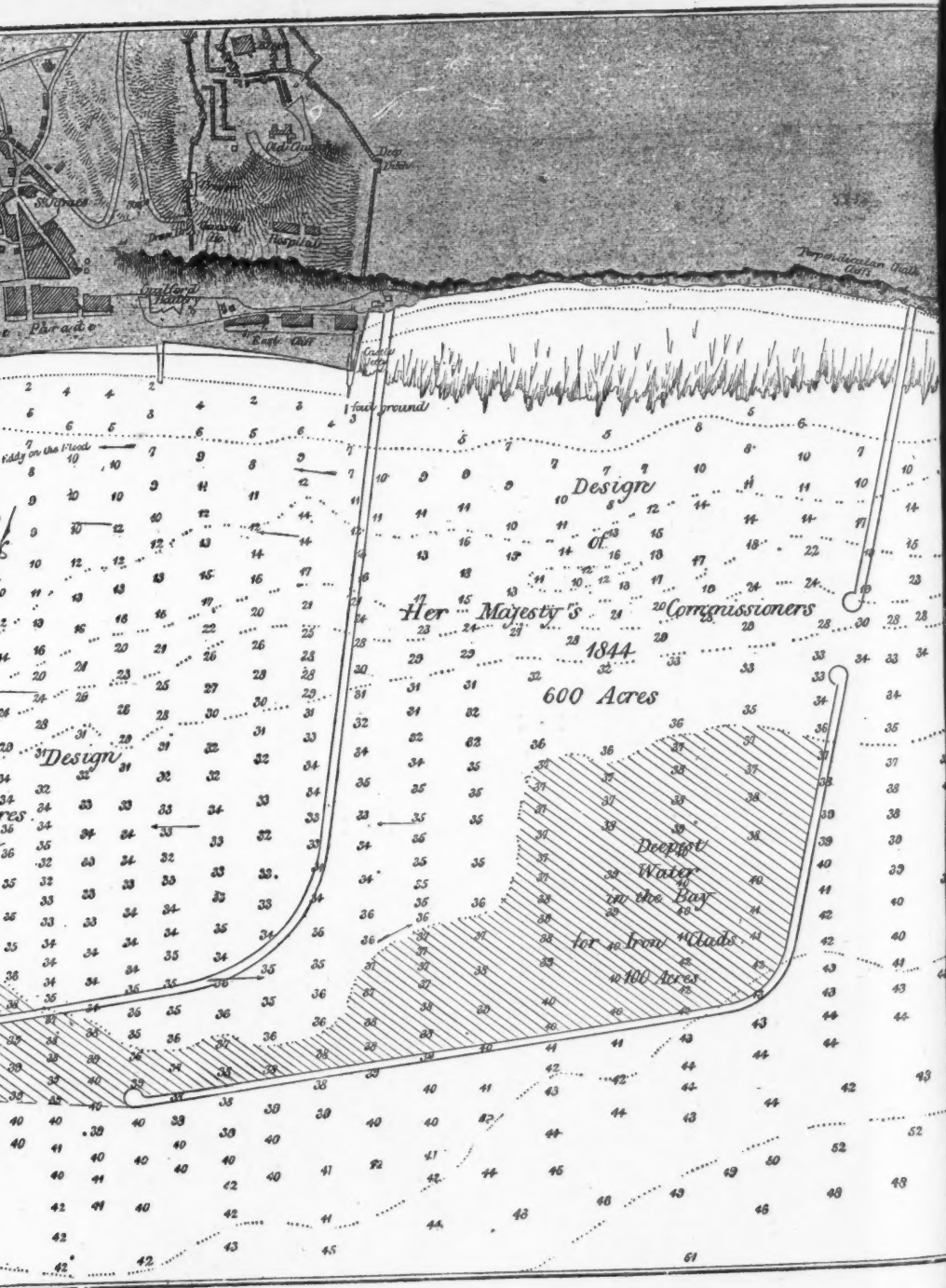
D<sup>o</sup>.....Lieut Worthington 1845.

Cornhill & Blagden

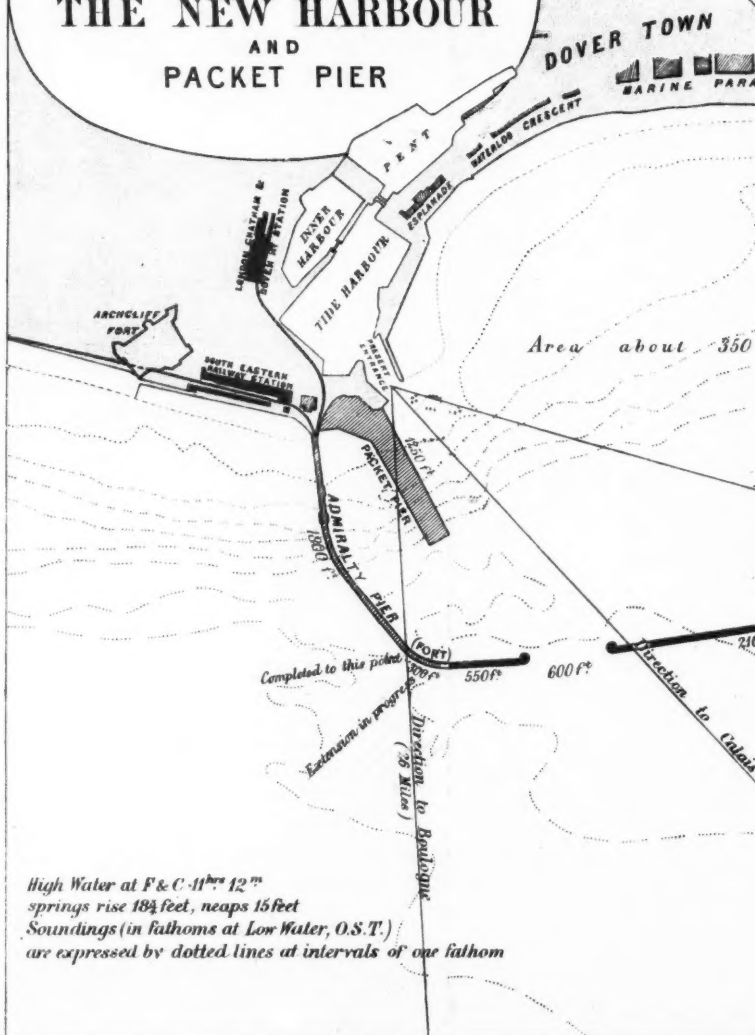


Soundings in Feet at Low Water Springs.





# CHART OF DOVER BAY SHEWING THE NEW HARBOUR AND PACKET PIER





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A joint report by Colonel Thompson and Captain, afterwards Admiral Beaufort, recommended in any design for enclosing the bay that the East and West Piers should be connected with the shore and commenced *simultaneously*.

The report of the Harbours of Refuge Commission, refers to this "advanced port on the south-east coast," and that it "has attracted the notice of sovereigns and ministers from the earliest times, and has led to a large expenditure of money, for the improvement of the present tidal harbour."

The opinion of Mr. Pitt, who employed the elder Rennie to report, is dwelt on, as also the satisfactory results of Captain Washington's examinations.

Both reports of 1840 and 1844, place Dover first on the catalogue of sites for harbours of refuge.

Before both these Royal Commissions, the highest naval evidence of the day was given advocating the enclosure of the bay; amongst others by Admirals Beaufort and Washington, Captains Bullock and Calver, R.N., and Mr. Iron the Harbour Master. That of the first has before been referred to, and Captain Bullock was of opinion, that taking all circumstances of position, present works, &c., into consideration, Dover was the most advantageous site for an artificial harbour of refuge, for the protection of the narrow seas, and that a harbour of refuge could not be made in the Small Downs, under any circumstances, equal to Dover, and that when coupled with defence, the latter site was preferable to any. Captain Calver gave similar evidence, his fear of deposit *then* arose from deposit from the *fresh inland waters*, and he considered the communication between the Inner and Outer Harbours should be cut off, and he did not apprehend much deposit from the still water, however, it would share, he supposed in a degree with Ramsgate this objection, but there would be less deposit, due to the greater depth and consequent distance it had to fall.

A diagram (Plate XXVIII<sup>1</sup>) is given of the main designs that have appeared on this subject, viz., that of Henry VIII; the Government in 1840; that by Sir William Cubitt, 1843; by Sewtard, 1843; the Government design, 1844; and last, that by Captain Vetch, a Royal Engineer Officer at that time (1844) employed by the Admiralty.

It will be observed that the eastern termination of the Government designs of 1840 and 1844, do not extend one-half the distance from the Castle Jetty to the Cornhill Telegraph, west of the South Foreland, it has, however, been industriously stated of late that the great Harbour of Refuge project extended to the latter point to throw discredit upon it, involving as it would then appear, the enclosure of double the area of water ever contemplated by any Government, and Captain Calver, R.N., in a recent pamphlet in defence of certain changes of opinion, or modifications of view, has not hesitated to state that the Cornhill Telegraph was the point selected for the

<sup>1</sup> The originals of Plates XXVIII and XXIX are from "Engineering," and of Plate XXX from Captain Hoseason's pamphlet, "The New Harbour at Dover, &c." Plate XXIX represents Captain Sir Andrew Clarke's original design, Plate XXX his design, as modified and deposited in Parliament.



eastern termination of enclosure, *i.e.*, as before stated, double the distance eastward from the Castle Jetty to that really chosen.

The recent modification of the area proposed by Sir Andrew Clarke, R.E., is shown upon the Admiralty Survey, with the modified and *extended lines* (as compared with 1840) of the Government of 1844.

When the results at Holyhead, consequent on commencing with a defined area of enclosure, subsequently extended, are considered, it is hardly necessary to urge the importance of a very mature consideration being given to the selection of the site for the commencement of the East Pier.

By adopting a point just east of the "Castle Jetty," and reducing the distance to the outer lateral breakwater, the area is reduced one-half; but the length of breakwater is by no means diminished in the same proportion, as the absolute saving in length is one-fourth, and that at the sacrifice of 100 acres of deep water of 38 to 40 feet, available to ironclads, enclosed within the south-east angle of the design of 1844. The most sheltered portion, and away from and not interfering with the continental traffic, the more important when the probable altered conditions consequent upon the introduction of larger vessels are considered, and also distant from the stream of traffic to the commercial harbour.

The question of area appears to be illustrated by the Holyhead example, for Dover, as a great military station and anchorage near the Downs in time of war, commanding the navigation of the Channel, would appear to demand an increase rather than a diminution of the area of enclosure when the increase in the size of shipping is considered; and this without any reference to the condition of the Navy up to the present time, tentative and unsolved, and would appear to warrant the conclusion that Dover, as a naval station, should afford as nearly as the site will admit, the same facilities as Portland, Cherbourg, or Holyhead. It is also worthy of notice that the two areas of enclosures endorsed by Her Majesty's Commissioners of 1840-44, are almost identical, with this difference, marked and significant enough, that the design of 1844 enclosed a *larger* area, and projected from a furlong to a quarter of a mile further seaward, leading to the inference that Her Majesty's Commissioners were of opinion that an extended and not a reduced area of enclosure was demanded by modern requirements, added to which the finished head of the Admiralty Pier coincides with the south-west angular bend of the design of 1844, *i.e.*, 1,000 feet in advance, or seaward, of the same point of the design of 1840, another telling and significant fact.

The evidence before the Commissioners of 1840-1844 led to the same conclusion, that Dover was first in importance as compared with all other stations, military or naval.

The great length of time (thirty years) during which the Admiralty Pier, or Western Breakwater of the Enclosure, has slowly advanced towards completion, and the revolution effected in the Navy in that period have tended to the result that Dover is more thought of as a place of embarkation and disembarkation for the continental traffic,

than (if the Bay were enclosed) a most important adjunct of national defence, and the very key of our position, east and west.

All the works of military defence executed by Her Majesty's Government during the above period, conceived and carried out in a spirit emulating that which actuated Henry VIII, Elizabeth, Burleigh, and Raleigh, have been apparently planned to convert the site into a British Gibraltar, and would appear to lead to the conclusion that the base of the enclosed sea should approximate with that of the shore defences recently executed for the protection of the sea front, flanks and rear of the town.

An impression prevails that the Government design of 1844 extended to the South Foreland as before stated, and that would be two miles eastward of the town, whereas the whole area of enclosure, including the one mile frontage of the town, is only one and a half mile across the Bay.

The chief arguments that have been used in favour of a reduction of the area were its proximity to the Downs, and that harbours of refuge are not now required as they were thirty years back, due to the extension of steam and gradual extinction of sailing shipping.

As regards the first, the opinion of Captain Perry, an old merchant captain, and the naval commanders before quoted, may be referred to, as also the statistics of the Annual Wreck Register Chart, to show that the frequent casualties on the "treacherous" Goodwin Sands, to a great extent would modify this view.

As regards the supposition that sailing must be gradually superseded by steam shipping, though to a degree true, it is also in a degree hypothetical, as will be seen by a study of the Board of Trade returns of our trade, and navigation and shipping statistics, illustrating as they do the continued marvellous progressive increase of the commerce of this realm.

On this point the following curious calculation may be referred to which appeared in the *Pall Mall Gazette* of 3rd December, 1874, taken from the *Bureau Veritas*, and which no doubt may be relied on as tolerably faithfully depicting our commercial position as a maritime power.

*"Mercantile Navies of the World."*

			Tons.
No. 56,289 sailing vessels	..	..	14,523,630
„ 5,365 steamers	..	..	5,034,337

So that sailing vessels are yet ten times more numerous, and carry nearly three times the commercial tonnage. And to show our pre-eminent commercial status, one-third of the above amount of sailing vessels are British, viz., 36 per cent. of the vessels and 37 per cent. of the tonnage. As regards steamers, more than one half are British, viz., 58 per cent. of the vessels and 60 per cent. of their tonnage.

The present unfinished state of the design leads to the result that there is a considerable local shoaling under the pier and deepening elsewhere—what has in effect been termed a redistribution of material,

the average depth over the bay remaining unchanged, and would no doubt cease on the completion of the enclosure, or would rather take place to leeward of it, and beyond its area.

This result has been well described in a joint report to the Admiralty of 17th May, 1865, by Admiral Bethune and Captains Calver and Bedford, R.N. There is one important paragraph in this report that may be quoted, viz.:

"We may mention incidentally that the Admiralty pier has proved "highly beneficial to Dover harbour, both by preventing the accumulation of shingle at the entrance, and by materially reducing the "silting up within, so that the harbour can now be taken at almost "any time when the depth of water will permit."

Without raising the question as to whether the Admiralty pier is the cause of the present absence of shingle eastward, as there are more active agents at work to the windward or westward of it, no stronger argument than the above quotation could be used for the immediate completion of the original great design of 1844.

Several objections may be enumerated against a retrenchment of the design of 1844, adopted by the Government after so much deliberation, viz.:

The loss of deep water south-eastward.

The curtailment of design limiting the frontage of the town to the Castle Jetty.

Thus fixing a limit to improvements eastward and reducing the length of sea promenade available to the town in the designs, 1840-44.

The loss of area north-eastward for the establishment of graving docks, ship yards, and other appliances for naval purposes, or for coaling on a large scale.

Also retrenching and rendering more difficult the communication by military roads with the Heights and Castle.

The enormous future expense that would be entailed if an outer harbour were found (as some of the advocates of the retrenched area have admitted might be) necessary.

More direct interference with the inner and commercial harbour, and also with the continental steam traffic, than in the design of 1844.

These sacrifices of area, frontage, the sea promenade in the bay being one of the chief attractions of the town, and the contingent opportunities of great local improvements the modification of the plan brings about, restricting the frontage to the old time worn boundaries, attempts to extend which have hitherto been checked by the ravages of the sea on the unprotected shore eastward of the Castle Jetty, where, however, there was a few years back a broad belt of shingle extending to Saint Margaret's Bay.

This retrenchment of the eastern boundary of the design by three furlongs, bringing it to a point just east of the Castle Jetty, producing the above results, involves a saving of 25 per cent. in the length of breakwater, but reducing the area in double the proportion, viz., from 600 acres to 300 acres, and that at a period when increased and still increasing tonnage for war or commerce is the order of the day, together with the improved means of defence by artillery of in-

creased and increasing range, and this applicable to an enlarged rather than reduced area.

It should not be forgotten that what is now termed the Government design is a modification proposed by a military engineer, Colonel Sir Andrew Clarke, R.E., and that it was only carried at the fag end of the Session before last, in a thin house, at a late hour, by a majority of one; and that the scheme was characterized by the Treasury as late as 20th June, 1873, as "not altogether mature;" and the present Government, on taking office last Session declined entertaining the question for want of sufficient information.

Admiral Washington, the late well known and respected hydrographer, absolutely recommended an enlargement of the design of 1844; the great Duke of Wellington was a firm supporter of the original project, and the military and naval authorities thirty years back were quite alive to the question of defence of the frontage, which must now be still more readily protected from the land side.

It is difficult to understand, as some have asserted, that the piers of 1844 would be less available in peace and war for embarkation and disembarkation; taking this view, it would be better to go back to the lines of Henry the Eighth's time, and have only an enclosed area of 150 acres.

To view the enclosure of the bay purely from a military point of view is surely a mistake, and a harbour of refuge in 1844 was intended as much for the navy as the mercantile marine; and to ignore the existence of the inner harbour is not politic, added to which the objection to sailing vessels in a naval station must have had the same force in 1844 as in 1873.

For the purpose of comparison, it may be stated that at Holyhead the original area proposed to be enclosed by the first bend or cant of the breakwater was 400 acres. This area was increased by extension and altering the direction, producing the ugly result before referred to, by an addition of 260 acres, making a total of 660 acres.

At Portland and at Cherbourg in each case the area of enclosure is 1,000 acres, and at Plymouth 700 acres.

As regards entrances, some of the designs contemplated a severance from the shore, this idea is now, however, by universal consent, in the best informed quarters, altogether abandoned.

In the first design of 1840, there were three entrances, respectively south-west, south, and south-east. In the design of 1844, a main south entrance and a smaller eastern entrance which although adopted at first in the present modified plan, is now abandoned, as it would promote deposit in the harbour at a rapid rate from the still water to leeward, when the enclosure is completed.

As regards position, the entrance of 1844, and that of Sir Wm. Cubitt, of 1845, are the best of all, for obvious reasons.

As regards width of entrance, all the best evidence of 1840-1845, show again that extension and not retrenchment, is necessary, and that an entrance of nearly 1,000 feet is necessary, and that no altered conditions of recent years affect this conclusion.

The question of entrances is one that will demand great considera-

tion, as in all probability a second entrance will be found necessary at the south-east angle, a site proposed by persons well acquainted with the port. Most undoubtedly the entrance shown in the amended design towards the south-west angles of only 600 feet, and not situate at the most salient angle of the enclosure will be found ill-placed and quite inadequate.

The late Sir Wm. Cubitt, C.E., Past President Institution C.E., in his amended design of 23rd Augst, 1845, which is perhaps, as regards approach, the best studied plan extant for the enclosure of the bay, proposed including 750 acres with a south-east entrance 450 feet in width, and 37 feet in depth at low water, and a southern projecting entrance of double the capacity, or 900 feet in width, and 42 feet depth of water at low water.

The following extract from an opinion on this plan under instructions from the Board of Ordnance and Admiralty by Lieutenant-Colonel Thomson, R.E., and by Rear-Admiral Beaufort, R.N., Hydrographer to the Admiralty, on the 9th December, 1841, respecting the entrances requires no comment.

"We would strongly recommend that both a western and an eastern pier be carried out simultaneously from the shore." . . . "to enclose a basin of equal dimensions to that in Mr. Cubitt's plan, but leaving an opening through the pier heads of 800 or 900 feet, through which any ships can beat in and out with undoubted facility."

Rear-Admiral Sir James Gordon, one of the Commissioners of 1840, and a witness before the Commission of 1844, held similar views.

Captain Bullock, R.N., another witness, considered two entrances sufficient, but preferred a greater width than 700 feet.

Captain Iron, for so many years the well-known harbour-master, advocated a width of 1,000 feet, for the main southern entrance.

Captain Calver, R.N., another witness, held that this entrance should be 900 feet wide.

The question of reduction of width of entrance, like that of enclosed areas, is mainly dependent on the assumed altered conditions of shipping, and this consideration the statistics before given of sailing and steam shipping will enable a judgment to be formed on.

Whether the enclosed area be of 600 acres, or of reduced dimensions, it is to be assumed that it will be a free port during peace, and a place of safety for ships, royal or mercantile, sailing or steaming, but its usefulness dependent entirely on accessibility and the character of its approaches.

It may be well here to state the capacity of the entrances of our great national harbours.

Plymouth has two entrances: 1,200 feet east, 2,000 feet west = 3,200 feet. Portland is an open roadstead to the north-east, round the end of the breakwater; the depth of the bay = 9,000 feet, with a small west entrance of 400 feet. Holyhead is similarly a semi-open roadstead, and has an offing or entrance round the north-east of the breakwater, 5,000 feet, and between the breakwater and rocks of the

inner anchorage = 1,000 feet. Cherbourg, like Plymouth, has two entrances, 1,400 feet east, 2,600 feet west = 4,000 feet.

The conditions affecting the entrance to a harbour are mainly these, extent of offing and winds acting thereon, average depth of surrounding ocean channel, depth of entrance at low water and rise of tide, the combination of these circumstances affecting the character of entrance required, and this is a very variable quantity.

The question assumes more importance in the case of Dover Bay, as if enclosed it will be the largest artificial national harbour of its class extant, as all the examples quoted above are either isolated breakwaters, or connected at one end only with the shore. A parallel may be found to an extent in Kingstown Harbour, Ireland, which is very accessible, and has remained tolerably free from deposit, but which, enclosing only 250 acres, has an entrance 750 feet wide. This example again illustrates the question of area, if 250 acres be required at Kingstown, in Ireland, what should be the area at Dover?

A second south-east entrance would be of immense importance on a sudden change of wind from east to west, to vessels wishing to get away up channel. The west entrance at Portland serving the same purpose on a change of wind in the contrary direction enabling small vessels to get away down channel without making the circuit of the breakwater.

By the Bill now before Parliament some modifications from the first reduced plan have been adopted, as shown by the deposited plan.

The east pier is proposed to commence 450 feet east of the Castle Jetty, and to extend 1,900 feet in a southerly direction.

South of this east pier an eastern opening no less than 800 feet in width is now proposed.

Southward of it, the eastern arm (in a south direction) of the South Breakwater is to extend 1,200 feet to the south-eastern angle of the enclosure, and thence in a south-west direction, 2,100 feet to opposite the end of the Admiralty Pier, to be extended 550 feet eastward, leaving an opening of 600 feet, by which the enclosure is completed southward.

No less than three designs have appeared for this retrenched area of enclosure, and all emanating from the same quarter.

In one case with a single south-west entrance of 550 feet.

In another a similar south-west entrance and an eastern one of 300 feet only.

Whilst in the last design we have a south-west entrance as before, with 800 feet of eastern entrance, and that at a point where all the other enquiries placed the smaller entrance.

This fact that the entrance space is already doubled by the authors of the modern design consequent on two years' deliberation would apparently tempt one to draw the conclusion that a continuation of their studies might produce a similar happy result as regards the enclosure area.

It must be remembered that our national harbours at Holyhead, Portland, &c., are the outcome of the harbours of refuge and similar enquiries, and that although there has been considerable change of



opinion as to the necessity of providing asylum harbours for commercial vessels, that the site at Dover was ranked as first, either for national or mercantile considerations as regarded the traffic of the narrow seas.

It must be patent that the Downs offered the same facilities in 1840—1844, duly considered by the Commissioners of those years, as at the present day.

The proportion of Baltic and North Sea foreign imports and exports is precisely  $35\frac{1}{2}$  per cent. of the whole foreign tonnage of the port of London, two-thirds of which nearly thus pass through the Straits of Dover, and during the last quarter of a century from 1850 (when the yearly aggregate foreign tonnage was under 4,000,000 tons) this trade has more than doubled itself, and the average tonnage of ships carrying this enormous commerce has increased from 200 tons per ship to 400 tons. The yearly tonnage now exceeds 8,000,000 tons.

To what inference, as to area of enclosure at Dover, do these statistics lead?

A comparison of the Admiralty Charts of 1859, 1873, shows the following general results, the whole of the shore to the westward of the Admiralty Pier has grown out. The amount of deposit, averaging vertically about  $2\frac{1}{2}$  yards, but in places where heaped up against the pier, amounting to from 12 to 16 feet.

The total amount of deposit on this side, as far as the charts extend, is over one million cubic yards, this quantity may, however, be indefinitely enlarged, as the action no doubt extends westward to Folkestone.

As regards the shoaling east of the pier, one-half is due to the silting up of the head of the deep water from the westward, formerly extending east of the pier, and which existed in 1859, filling it up to the normal depth in the bay north and east of it, with as much additional deposit above.

In fact, if the deep water patch, in the chart of 1859, be compared with the area of deposit of 1873, it will be seen that the outline of the deposit spit, is almost identical with what was the termination of tidal and wave influences in former years. (Plate III.)

The whole quantity is about 400,000 cubic yards, and would possibly, at a shilling per cube yard, represent from £1,400 to £1,500 per annum for dredging.

The amount of shoaling at the various landing jetties is as follows, at the north-west jetty there is apparently about the same amount of water, at the main west jetty there is 7 feet loss of water, at the inner north-east jetty there is no loss of water, at the outer north-east jetty there is likewise no loss, but at the main eastern jetty, which is situate at the centre of the spit or shoal of deposit, there is a loss of no less than 17 feet.

This is a matter which will no doubt receive careful consideration from the Committee of the House of Commons now sitting.

The bay generally is as deep and even deeper in places than in 1859.

If the number of wrecks be taken as an argument in favour of



harbours of refuge, it is a more cogent one now than in 1844, in a two-fold degree.

It appears from the wreck chart, compiled from the Admiralty and Board of Trade returns, that in the five years, 1852—1856 inclusive, the number of vessels wrecked on the coasts and in the seas of the United Kingdom, was 5,128, or an average annual loss of 1,025 vessels, and the loss of life, as far as can be ascertained, 4,148, or an average annual loss of 829 lives.

From the same sources of information, it would appear that in 1871 the number of wrecks was 1,927, and the number of lives lost 627. In 1872, number 2,381 wrecks, and number 590 lives.

So that the average number of wrecks is double, but the loss of life (due no doubt to the Life-boat Association and improved means of communicating with wrecks from the shore) has been reduced about 25 per cent.

Lamentable as this increase of wrecks is, due to the more crowded condition of our seas and the more constant passage of steamers, it must not be overlooked that the Board of Trade returns show conclusively, that the export and import tonnage of the United Kingdom during the above twenty years has more than doubled itself; the total tonnage with cargoes and in ballast being, in 1852, just over sixteen millions of tons, and in 1871 much over thirty-six millions of tons, fully accounting for the increased number of wrecks.

The saving of life, due to the meritorious efforts of the Life-boat Association, bears therefore a much higher rate of decrease than as above stated.

The real proportion per vessel would stand thus:—

		Proportion of man per vessel.
	829	
1852—1856.....	—	= .80
	1025	
	626	
1871.....	—	= .33
	1927	
	590	
1872.....	—	= .25
	2381	
	728	
1873, six months	—	= .60
	1206	
Number 1206 vessels.		
728 lives. <sup>1</sup>		

The practical result is, therefore, that 50 per cent. more lives now are saved proportionate to the tonnage traffic, than were saved twenty years back.

To show the importance of starting sufficiently eastward with the eastern breakwater, so as to be able to enclose as large an area as

<sup>1</sup> Number 293 in one crew, the "Northfleet."

modern enquiries, experience, and demands may require, reference has been made to the cases of Holyhead and Alderney, in both which cases, from the breakwaters having been extended in length and further out seaward, than at first contemplated, a valuable area of anchorage has been lost in each case, that might have been additionally enclosed, had the ultimate terminal head of the breakwater in each case been designed from the first, when these works were started.

The areas thus lost are at Holyhead 70 acres, which would have added just over 10 per cent. to the present area of 660 acres now enclosed, and with a better line and shorter length for the breakwater; at Alderney similarly the area lost amounts to 40 acres, or 33 per cent. of the area of 120 acres, now enclosed with a shorter length for the breakwater, now curved in the wrong direction on plan.

In each case these lost areas would be higher, supposing the piers had been planned so as to form a segmental arc seaward.

The national character of this undertaking, its importance in the event of war, together with the great commercial interest of the question, appeared to the author to warrant a recapitulation of what has taken place up to the present time, to bring about this desired result, and that before no more fitting tribunal than the Royal United Service Institution, could such a subject be brought, as the proposed enclosure of Dover Bay.

Questions have been asked as to the object of this paper. They are mainly to direct attention to what is under cover of a hybrid, half private, half Governmental Bill, before the Legislature, an attempt to obtain powers for one of the greatest works of modern times, respecting which, amongst those really possessing information on the subject, considerable disparity of opinion exists.

His Royal Highness the Duke of Cambridge, Commander in Chief, whilst under examination before the Committee on Thursday last, was asked by the Chairman,

"Your Royal Highness considers this proposal one of the most  
"important that ever came before Parliament?"

He replied

"Certainly."

His Royal Highness was further asked by the Chairman,

"Is the area of the proposed Dover Harbour sufficient for  
"military purposes?"

His Royal Highness replies,

"It is sufficient, but if a greater area could be given so much the  
"better. *We want plenty of room*, and I should accept the  
"Dover Harbour as the best I could get, *but not as all the space*  
"*we want.*"

His Royal Highness's evidence most entirely endorses the author's

chief proposition, viz., that the deposited plan now before Parliament, as regards area, is inadequate, and that the Royal Commissioners' design of 1844 requires expansion rather than reduction.

It must also be borne in mind that His Royal Highness was speaking as a military witness, and was not asked a question respecting the commercial harbour or the increased space required for colossal Bessemer, Dicey, or other steam ferry boats.

The second object in this paper has been to direct attention to the altered condition of the bay, due to lapse of time, unknown to a large number otherwise interested in the subject, and the extent of which is denied by many who do know and can appreciate the gravity of the circumstances, viz., the enormous amount of silting which has taken place to windward and leeward of the Admiralty Pier, and for which, in its full extent, the author was certainly not prepared, although he has for more than thirty years back devoted special attention to this particular subject, and has been largely employed by Her Majesty's War Department in reporting on coast changes as affecting Government works in the Medway, at Deal, Sandown, Dover, Eastbourne, &c.

These two considerations, the inadequate area, coupled with the vital importance of selecting a point sufficiently eastward for the east pier of enclosure, to avoid such mistakes as those at Holyhead and Alderney, and the very grave question of the silting up, and its possible future conditions when the bay is wholly enclosed, are, it is submitted, two sufficient apologies for this voluntary and unasked-for contribution to the subject from one who, from professional connections, has made the subject one of years' consideration.

As regards the objection to harbours of refuge, it is one of name more than aught else.

The Royal Commission of 1840 was appointed to report on the harbours of the south-east coast, and gave no definition to them.

The Royal Commissioners of 1844 show that their views as regarded Dover were as much strategic as aught else, as they reported in the following terms, viz. :—

"History affords proof of the importance attached to this place  
*"as a military and naval station.* As the advanced post on  
 "the south-east coast, the want of a harbour here of sufficient  
*"capacity for the reception of vessels of war,* and for the convenience and protection of trade, has attracted the notice of  
 "Sovereigns and Ministers from the earliest times."

The plan of 1844 was to meet those requirements thirty years back. The question arises, does a doubled commerce, leviathan ferry-boats, an ironclad navy, and increased inner harbour traffic, cry for a reduced area.

As regards silting, the foreshore accumulation westward is not likely to prove serious for the enclosure, and as regards the deposit east of the Admiralty Pier, this, in a modified amount, may be expected mostly to leeward, or east of the enclosure.

These results are drawn from two Government documents—the Admiralty Charts of 1859 and 1873; but they are accompanied by a deepening on the inner side, due to the counter flood current caused by the pier.

The CHAIRMAN: The object of our discussions in this Institution is to call out the expressions of opinion of the members of the two professions upon the importance of any measures relating to the defence of the kingdom, and also upon the merits of the details of the plans for such measures. We have already had here some discussion about the general importance of Dover as a military harbour; and, to-night, Mr. Redman has more particularly brought before us some questions relating to detail, and particularly to alterations that have taken place in the harbour, and affect the question considerably. I hope, therefore, we shall have some opinions expressed upon these points.

Captain BURSTAL, R.N.: It has given me great pleasure to hear Mr. Redman's paper read by him. It is unquestionably a subject of very serious consideration to everybody concerned, whether there should be an artificial harbour at Dover or not. I am not at all sure that the feeling of the nation generally is in favour of a large harbour, such as is projected at Dover. That facilities should be given to Dover for the approach and departure of steam-vessels communicating with the Continent, there can be no question whatever. In a military point of view, I dare say, although I am not competent to pass an opinion upon that, from the evidence given by H.R.H. the Duke of Cambridge the other day, it appears that Dover is so locally situated as to make it a most eligible and desirable point of departure in case it should be necessary at any time to embark an Army. Now, affording facilities for naval purposes is another question, and to my mind not only as a sailor, but having been on that coast a great deal, having been the chief assistant on the survey of all that coast, having prepared all the manuscript Admiralty charts of it, and knowing the locality not only of Dover, but of the Downs, of Margate roads, and of one of our principal naval stations, Sheerness, it becomes a question really whether with ships such as we have now, which will ride out any gale in the Downs; and certainly if the wind blows so hard through the Downs from the S.S.E. or S.E., as to oblige those ships to up-anchor and take shelter in Margate roads, it seems very clear that no enemy could keep the sea; therefore, looking at the thing in a nautical point of view, an Officer in command of a fleet would necessarily say to himself, "Where is the best place for me to be? Is it the Downs, where I can run round into the Margate roads and get supplies of coal, or whether it should be, locked up in Dover Harbour subject to be shelled by any one of the enemy's gunboats that thought proper to take a position three miles off where it never could be hit by guns from the shore; for a gunboat stationed two or three miles off can always know exactly her position by means or angles, and regulate her fire so as to shell anybody out who happened to be locked up in that harbour. The desirability of putting a harbour there is, perhaps, not the question under discussion; but still I do think it is one of those points that is interesting to all those who have got the subject under discussion, although it may not be a point under discussion in the House of Commons, for it almost appears, as a matter of course, that they are going to make a harbour there. I think, if they are going to have a harbour there, if it is desirable in the minds of those who know a great deal better on these subjects than I can pretend to, that the eastern jetty should be brought as far to the eastward as possible, and, by so doing, a very much larger space of deep water will be obtained for large ironclad ships to ride in and to take in coals or whatever they may require, leaving the western portion of the harbour for smaller ships. Although I have not for many years examined the depths in Dover Bay between the town and Cornhill Telegraph, yet I have them in my head, and I feel quite sure if the eastern jetty is projected somewhere by the Cornhill Telegraph, they will not have to go very far out before they get to deep water; whereas if the eastern jetty is brought out, probably from the Castle Jetty, they will then have to bring the eastern jetty a considerable distance out before they get beyond a depth of five fathoms at low water.

Mr. REDMAN: The distance is some fifty per cent. greater.

Captain BURSTAL : If the eastern jetty is brought out somewhere to the eastward you will get out to deep water very much sooner, and make a better harbour with very little more expense, and get a very much larger acreage. Those are subjects, as the harbour is to be put there, that are very well worthy of consideration.

The CHAIRMAN : We have here to-night a gentleman who is as well acquainted with Dover Harbour, in its present condition, as anybody in the world, and that is Mr. Druce, the engineer, who has been in charge of the construction of Dover Pier for a great many years. I hope he will favour us with some information respecting the present condition of the harbour and his views with respect to the construction of the project now under consideration.

Mr. E. R. U. DRUCE, C.E. : I have some little difficulty in going minutely into many of the details of the project now before the Institution, from the peculiar position in which the subject stands. It is at the present time, as you are aware, before a Committee of the House of Commons ; and, as opinions will have to be expressed, and the subject fully discussed, it is rather premature on my part to say much about it. I should like, however, to refer to one or two points which Mr. Redman has brought forward in his paper. In the first place, he notices as a prominent point (and a very important one it is too) the proposition of the Commission on Harbours of Refuge, and of a harbour in Dover Bay of 1844. I think Mr. Redman somewhat misunderstood the proposals made by that Commission. He referred to an eastern entrance. Now I think they distinctly said they would have no eastern entrance at all. They said they would have a harbour with a minimum area of 520 acres ; and their report further shows that they contemplated two entrances of 700 feet each in width, and no others at all. The original Commission of 1844 reported, in the first instance, in general terms in favour of a harbour at Dover, besides mentioning some other places where they considered harbours were required. After that, the Government called for reports from different engineers, six or eight in number. Those engineers sent in their reports with plans ; and the Commissioners, or part of them, met a second time to consider those reports. The result of their deliberation was that they somewhat varied their original report, and recommended that there should be no entrance in the eastern arm at all, but *two* in the southern face or breakwater. I believe that is the condition in which the matter stands as far as their report goes. With reference to the present scheme, the position of entrances and the width of them, must be left undecided until the area of the harbour is definitely settled. The limits of deviation proposed in the present Bill are very large indeed, and it would be very premature to settle the width and size of these entrances, which seriously affect the velocity and current of the tide going into them and filling the harbour, until the area itself is settled. I think, therefore, that the position and size of the entrances must be considered as an open question at the present time. With reference to the silting on the west side of the pier there is an important feature omitted. The whole of the sewage of the town now goes out just to the westward of the present Government or Admiralty Pier ; and that, I think, will account for a very large amount of the deposit that takes place on the west side of it. I do not think it ought to be called silt on the east side, the term is not an appropriate one. The accumulation arises from a totally different cause. It is merely a re-distribution of the bottom caused by the running out of the Government Pier which is to form the western arm of the new harbour, and not doing as everybody would have liked to have done, viz., running out the eastern arm concurrently with it. There was possibly an uncertainty in the minds of those who were in authority at the time as to what the size of the harbour should be, but whether that or financial reasons was the cause, the commencement of the eastern arm was postponed, and currents and eddies were formed which have done more harm than good to the bottom of the Dover Bay. The report or survey of the Committee of 1865, which is in print, shows distinctly that that re-distribution can be traced to a cause which is quite intelligible. The subsequent survey of 1873 leads also to the same conclusion, namely, that the eddy of the tide running along the shore of the bay has disturbed the bottom, and is so doing a great deal of mischief. That, I think, I pointed out at least twenty years ago as an inevitable consequence. I was told it was premature to consider the question then. It has, therefore, remained for the authorities of the

present day to take up the whole subject afresh, and give it such consideration and take such steps as they may deem to be most advisable; and, as all existing contracts are being rapidly finished, it will be necessary to consider whether it shall be finally closed or something further carried out.

The CHAIRMAN: Can you tell us definitely that the amount of filling up, marked on Mr. Redman's chart, is possibly a re-distribution with regard to amount, and whether it can be accounted for?

Mr. DRUCE: The survey of Captain Calver and his Committee, in 1865, stated distinctly that the mean depths of Dover Bay as compared with those obtained from the surveys of 1848 and 1859 were practically identical. I have also taken out the quantities of the new survey made by Captain Parsons in 1873, and the same result is unmistakably shown. The shingle, I may add, on the west side of the pier is of course another thing; that has simply disappeared owing to the prolongation, seawards, of Dungeness.

Mr. SCOTT RUSSELL, F.R.S.: I will take the liberty of saying that I always felt considerable interest in Dover Harbour, as an international communication; but I have also felt a deep interest in it, as I might almost say, a naval and military station, because I had the fortune to be a professional member on what we called the Committee on National Defence, for some time, and it became my duty to investigate many questions of that kind, and I only feel embarrassed now in making any remarks upon this subject, because I think it is so important a strategical and national question that, first, I do not like to discuss it even in so choice an assembly as this, and, secondly, I think I should like to leave an energetic Government, if the present is one, with their hands quite free and unembarrassed to act very energetically. I was delighted to hear from Mr. Druce, that the latitude reserved by the proposed Bill is extremely great. I should approve of the design now proposed just in proportion as the latitude to deviate from it was extremely great. The diminution of the harbour in area, which I hope we have no reason to apprehend, notwithstanding these plans, is a great and unmitigated evil. If anybody apprehends anything in the shape of silting in a large area, you have the means of preventing the silting; if anybody is apprehensive of any inconvenience from heavy seas with wide entrances, the cure for inconvenience from heavy seas necessarily is what? Size; there is no other cure. Therefore it becomes a good and effectual harbour in proportion as you give it great area; and convenience and safety in entering and going out, requires a certain width of entrance, and that renders large area indispensable. Therefore, I think we are in positions in which we can only trust that the Government, whatever its present estimates may be, may one day have very largely increased estimates and very largely increased works before they are completed. Let us give them credit for that. There is another point I would just venture to say a word upon, because I think we might get some explanation from Mr. Redman or Mr. Druce in regard to it. I have a good deal studied the action of the waves on the entrance of harbours at Kingstown, at Holyhead, at Portland, and in some of the harbours of France, and I must say that a good deal of the comfort, convenience and stillness of the harbour is owing to the choice and arrangement of the entrances. Now, I did not quite catch whose plan that uppermost central one is, but it strikes me as remarkably good.

Mr. REDMAN: That is the plan by the late Sir William Cubitt, that I distinguished in my paper in the most favourable terms.

Mr. SCOTT RUSSELL: Permit me to say, when I look at the position of the entrances of that particular design, and when I look at the position of the entrances in the now proposed design, I cannot help thinking that upper design very much better as regards the entrances than the lower. I will guarantee as far as my experience and observation goes, that that arrangement will give much more stillness than the other. Not only that, but so far as I can see, that design is calculated in the best manner to give the largest area with minimum length of enclosed pier; and I am at a loss to discover, which perhaps Mr. Druce will tell me, what the meaning of the very sharp corners is in both of these two designs; for as we all know your sharp corner is a great expense in proportion to the small area enclosed. Conceiving then that those entrances are better designed, and that the general outline is more economical, and the enclosure therefore more effectual for a given cost in that



upper plan, I should be extremely obliged if I were enlightened as to the merits in the other plans which have made it expedient not to adopt that upper plan, of which I knew nothing until I came to this room. I think we are very much obliged to Mr. Redman, who with his usual professional energy, and his usual research into the works of others, has given us his own ideas very luminously, and also put us in possession of the succession of ideas and plans which have been proposed for Dover Harbour. I believe that all the impediments and troubles we have about navigation from Dover to France, and Dover to the Continent is caused by the shallow, insufficient, bad entrance at Calais. I know that one or two successive Governments were perfectly aware of that; and it so happened that three days ago I got a letter from an eminent statesman in Paris, stating to me that I must not understand from the fact of the tunnel being promoted, that that had anything to do with the not creating a new and adequate harbour at Calais, and that there is every intention to create a deep water harbour at Calais, which they hope will be ready as soon as our harbour on this side is complete. No doubt that will be considered good news.

The CHAIRMAN: Captain Hoseason, will not you favour us with some observations? Dover is your child.

Captain HOSEASON, R.N.: I have said so much about Dover that I do not see what I should say more. All that I have advocated with reference to it has been supported by the first people of the country. I endorse every word that you and the talented gentlemen have stated as evidence before the Select Committee. You must understand my share in this transaction. I do not come here to propose any particular harbour. On arrival from the Continent, I found on my friend General Collinson's table a plan drawn up by the Harbour Board and Sir John Hawkshaw, on the part of the Railway Companies, which I think would have ruined the port of Dover. I entreated General Collinson to oppose it, pointing out to him the faults that I saw in this plan. I advocated that the harbour ought to commence beyond East Cliff jetty; and that plan is adopted by the Government, not because they entirely approve of it, but because it is all that they can do for the money. It is a case of £ s. d., and if my friend, Sir George Balfour, who can deal so ably with finance, will only say, "Gentlemen, you have made rather a restricted harbour, we are willing to 'give half a million more'—half a million will only give you ½d. on the Income Tax—'consequently we will give you the money if you will improve the harbour.'" Then we shall have a harbour to meet partly Mr. Redman and Mr. Scott Russell's views. Now, £970,000, to construct that harbour, is a very small sum; I doubt whether £970,000 will cover it, filling up that eastern entrance, which is 800 feet. I am not prepared to say, in that draught of water, what the expense of closing the aperture will be. No doubt the enclosure to the southward will be enlarged, and as that entrance is in deeper water, more expense will be saved in that part than on an equal quantity of shallow water. With regard to a question asked by Sir George Balfour, why, when the Government changed their plan of 1865, they opened the question *de novo*, I reply that they did so because there was a plan brought before them either to accept or reject, and they were forced to it by the Harbour Board and the Railway Companies. They did not go into it with any sympathy, for I think I can prove that the Board of Trade did not like the matter, but they were forced into it because they felt they must either let the Railway Companies and the Harbour Board do something, or do something themselves; and when they came to look into the matter, they found the funds at the disposal of the Railway Companies and the Harbour Board would not enable them to undertake any such enterprise as was necessary, and so the Government took it up, still limited in their funds. I think I have answered that question which was asked in Committee, and I think the only reason the Government did not go into a larger enterprise was that they felt the funds were restricted.

Lieutenant-General Sir GEORGE BALFOUR, K.C.B., M.P.: I came here to-night to get information on this very important national work, and I confess I have received it in a very full manner. Of course I need not say that it is not proper for me to express any opinion, one way or another, with regard to the practicability of constructing this harbour, seeing the position in which I at present stand with regard to the inquiry by the House of Commons; but I must say, the information which



Mr. Redman has given us, with regard to this project, is well deserving the attention of the Select Committee at present sitting on this harbour. I have also listened with great interest to what Captain Hoscason has said, and I may truly add that, if the Government consider it necessary for the defence of this country and the efficiency of our service, that they should form a harbour of this kind at Dover, it is incumbent on the country to provide the money to establish it. The question is, not only whether the country desires to have this harbour for the maintenance of our independence, but the next great question is as to the form of this harbour. I think I may say that the question of the present limited area of the harbour is entitled to great consideration. I have listened with great attention to what Mr. Scott Russell has said, and I think it well deserves the attention of the Committee now sitting on this harbour, as to whether its area of the extent proposed, of 310 acres, will make it that efficient port which we desire to have for our Navy, as well as in part for our commercial marine. - Then, with regard to the form of the harbour. I think Mr. Redman has very justly and properly brought to prominent notice the various outlines of the Dover Harbour works proposed in former days. I think that the former very carefully prepared plans for the Dover Harbour works well deserve the attention of the Select Committee. Also, as to whether any suggestions could be derived from the former reports, which would make the present proposed harbour more efficient. I think this useful lecture is also extremely well deserving of Mr. Druce's attention, because, from having for twenty-five years held the important office of resident engineer, and superintended, on behalf of Government, the construction of the Admiralty Pier at Dover, he would be a very valuable witness before the Select Committee, well entitled to have the confidence of Government in any advice he may give. It appears to me to be important that we should ascertain distinctly, not only the maximum area in acres we need at Dover for the various purposes, but also at what cost per acre of area on the sum we are now prepared to expend, but also ascertain, according to Mr. Scott Russell's suggestion, whether with a small additional outlay the proposed area could not be so enlarged that we could get a much larger available area, and of increased depths in the areas or zones, at a much smaller rate per acre than we can attain with our present planned area and expenditure. These are all questions well deserving of the consideration of all engineers, and I hope some of the gentlemen who have spoken to-night may be summoned before the Select Committee, for the purpose of giving that information which will, if adopted, be invaluable to the nation. The suggestion Mr. Redman has thrown out, with regard to the collection of silt, or rather mud, well deserves the attention of the authorities. I am sure Mr. Druce will give his best consideration to it, and be prepared to show in what manner this very suspicious appearance of a large collection of mud close to the lee of the present Admiralty Pier will be likely to continue, or be extended, in the case of the eastern pier being erected. These questions are well deserving serious attention, because they are not only questions of £ s. d., but also involve the very existence of the harbour. I admit that, if the nation needs this harbour for offence or defence, then we should be prompt to expend the money required to attain our object. My caution is simply to ascertain whether, when the harbour is made, it will remain effective and not be silted up. I frankly avow that I should doubt at the present time whether the million of money proposed to be spent on Dover would not be better laid out on the commercial harbours of the kingdom, than in this one port, for I view, with great alarm, the dangerous state to which the commerce of this country is exposed from competition. I see foreign nations improving their commercial harbours, and affording such accommodation as to lead to an extension of their commercial marine. I, therefore, say to you frankly that, deeming our greatness to rest on the commercial prosperity of the country, you will see how important it is that the trading harbours of the kingdom should be made, in every respect, efficient and fit for our commercial industry. It is in that form we shall aid in maintaining our national greatness, and create the funds which we need for our defence. If we once lose that commercial superiority, you will allow that England will dwindle down to a very small nation indeed. Therefore, whatever difference of ideas I may have with regard to a military port at Dover, my friend, Captain Hoscason, knows well what my real views are. I need only say, that I

desire to obtain that which is best for the benefit and advantage of our country. In conclusion, I hope General Collinson, you will express, in suitable terms, the great obligation we must all feel, but especially that I feel, for the opportunity we have had to-night of obtaining the very valuable information with which Mr. Redman has furnished us, regarding this great national work of a naval and military harbour at Dover.

Captain ROSEASON, R.N.: Hearing from the General who has just sat down that he will avail himself of Mr. Druce's able assistance, may I suggest one or two others who can give most important evidence? I would point to Captain Morgan, who has been responsible for all the packets at Dover for years. He, I think, will tell you that there are certain gales during which the Government pier is no protection from either side, and that he has been out of bed, night after night, in intense anxiety, to know what to do with vessels, and that he has had occasionally to send them to the coast of France for protection. I wish, also, to call attention to Captain Bruce, who has, perhaps, more than any person out of England, made the passage to and fro. He will reiterate exactly what Captain Morgan will say. These are practical men, who can speak of facts ten times more effectually than I can.

The CHAIRMAN: Mr. Scott Russell has told us very properly that this is not the proper place to discuss questions of international polity, or political questions concerning the defences of the Empire; but still I think we may fairly say, as far as the discussions have gone, not only to-night, but on previous nights here, that there is a very general concurrence of opinion amongst both professions of Her Majesty's Service, that this is a very important question for the country, and that there are times when it should be taken up in a very serious manner. As regards my own opinion, not only in a naval and military, but also in a commercial point of view, as a harbour of refuge I do not think you can make Dover Harbour too large. Captain Burstal has told us about the state of the Downs, and I think Mr. Redman mentioned that the Downs in 1719, or thereabouts, was considered to be a troublesome anchorage, which vessels were frequently obliged to run from. I have heard the same opinion expressed in these days by gentlemen belonging to the Trinity House, that there is a great deal of trouble to the vessels lying in the Downs, in consequence of the numbers, and perhaps in consequence of their being badly found; that a good deal of damage is done by their fouling each other, and that, therefore, it would be desirable, if possible, to devise some remedy for it. Then, again, as regards the Downs as a good war anchorage, the question should be considered as to the power of coaling there. Captain Burstal mentioned with regard to that, the possibility of going round to the anchorage off Margate, where there is greater shelter and coaling there. I do not think myself, speaking as a military man, that it would be very wise in war time to trust to coaling at all in the open sea whatever necessities may call upon us to do, so I think it will be wise for this country to provide means of coaling in secure harbours, not only for the safety of the coal and of the vessels, but for the certainty and expedition of performing the operations. Mr. Redman has told us, in Henry VIII's time, it was proposed to spend about £80,000 upon the harbour. I cannot help calling attention to the great sagacity, boldness, and patriotism of the Government and country in those days in proposing such a scheme. When you look at the drawing upon that chart, you will see that for the ships then employed, and the circumstances of that time, it was quite as large a scheme as any that we are proposing now for our day. That £80,000, if it was really turned into money at the present day, would represent £800,000; and if you compare the population who were to pay that £80,000 with the population of this day, it would have to be multiplied again by about eight. I should think you will agree that that was a time we may rather imitate than later times, when smaller projects were thought sufficient.

Mr. REDMAN: I have already trespassed upon your attention so long that I have merely to thank you, and to thank the Council for the opportunity you have given me of bringing forward this paper: also to thank your Secretary, Captain Burgess, for the uniform courtesy with which I have been met by him. I take it there are very few points I have to refer to. My gallant friend, Captain Burstal, so entirely endorsed the views I have endeavoured to propound in that paper, that it leaves me little to say. Mr. Druce, my very old friend, naturally, with a reticence

which in his position I should feel myself, did not tell you so much as he might ; but the facts I have brought forward in this paper have not been disputed, and I have taken some trouble in arriving at them. He referred to the absence of shingle being caused by the accretion at Dungeness. Having been employed repeatedly on previous occasions to make inquiries on such questions for the War Department, I can say, without any hesitation, that there are other causes intermediate between Dungeness and Dover, which will fully account for the absence of shingle at the Admiralty Pier, because you must remember Dungeness was growing out in the time of Elizabeth, when Lungle Point, westward of Dungeness, did not exist, and Dungeness has continued to progress seaward at the same rate up to now. I think the accumulation at Folkestone is quite sufficient to account for the action at Dover. In the same way, the observations that fell from Mr. Scott Russell entirely endorse the views I have advanced. He asked whether we could explain the reason of this peculiar form of entrance now before a Select Committee of the House of Commons. I take it the circumstances of the case do to a great extent induce, that this south-west point, the end of the Admiralty Pier, is arrived at already, and is in fact the south-west angle of the enclosure of 1844, and the Castle Jetty, near the north-east angle, was about the minimum frontage adapted to give 300 acres, and it, to a certain extent, fixed this south-east point (referring to the diagram), formed by the intersection of those two lines of east and south breakwaters. Undoubtedly, the observations of Mr. Scott Russell were quite correct, that there are conditions about that entrance, as shown by the deposited plans now before Parliament,<sup>1</sup> altogether inferior to the salient projecting angular entrance of the design of 1844, or Sir William Cubitt's design of 1845. I have already trespassed too long upon your attention.

The CHAIRMAN : I have to request you to join in giving our thanks to Mr. Redman for the great labour he has taken in placing so large an amount of useful information before us. Although the audience has not been large, Mr. Redman must allow that it has been appreciative, and that it has brought forth a good deal of interesting information.

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<sup>1</sup> The two great questions in this really great and national one are—

1st. Is £1,000 per annum for dredging to be thought of as a bar ?

2nd. Is the addition of one-third to the proposed expenditure of a million sterling, to obtain a proper outline, and commensurate area of enclosure, and a salient well-designed southern entrance, to be weighed in the balance ?

PRESERVATION OF BISCUIT AND OTHER FARINACEOUS  
ARTICLES OF DIET FROM WEEVIL, MAGGOTS, AND  
OTHER INSECTS IN H.M. NAVY.

Communicated by W. E. SECCOMBE, Esq., Controller's Department,  
Admiralty.

I NEED scarcely say that for a very long period it has been found that the biscuit on board H.M. ships, when in a hot and tropical climate, has been rapidly attacked and destroyed by weevils and maggots, often to such an extent as to render it very repulsive, and quite unfit for human food, sometimes causing large quantities of it to be thrown overboard, or otherwise returned to the victualling yards when the vessel arrives in England.

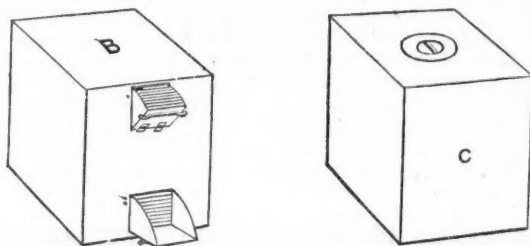
This damaged and worm-eaten biscuit has usually been sold by auction from time to time, as it has accumulated, for feeding cattle, &c.

After the commencement of the annual sales, about four or five years since, the large *quantity* of biscuit which came to the hammer, as well as the worm-eaten condition in which some of it was found, attracted the special attention of the officials at the Admiralty, and it was considered desirable that some arrangement should be made to prevent so great a sacrifice of the very first-class biscuit, which is regularly manufactured at each of the victualling yards.

Having had the honour of being deputed by the authorities at the Admiralty to attend at these sales, I thought it was possible to stow the biscuit in iron tanks, hermetically closed, in such a manner as to make each tank in the bread-room easy of access; and at the same time to be so closely stowed in the vessel as to carry the full complement of bread for the ship's company as if it had been filled in bags in the usual way.

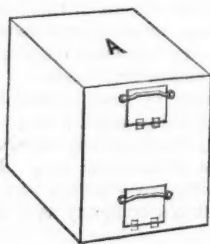
Having been requested to state the proposed mode of fitting the tanks, a rough sketch showing the form of scuttles for filling and emptying, &c., was forwarded, which obtained the approval of the proper authorities, and it was determined that three *trial*-tanks should be prepared at Deptford Yard (similar to sketch B), which should be filled with biscuit at Deptford, Plymouth, and Gosport Victualling Yards, respectively, and hermetically closed for twelve months, in

order to test the condition of the biscuit after being kept closely confined for the time named.



It may be observed that biscuit had been on several previous occasions put into iron tanks on board ships and in the storerooms at different stations; but, as a rule, it had mildewed and got spoiled, or had become infested with insects, which made some of the persons, who had considerable experience in these matters, somewhat fearful of the satisfactory results of the experiments about to be made; but the tanks formerly used were simply the old water-tanks with the manhole at the top, which necessitated the sending some one into the tank from time to time to get out the bread, which operation is, in itself, very disagreeable to persons eating the bread, while the constant opening and shutting the manhole (see sketch C), which is on the top of the tank, allowed any water falling on the tank to get into it, and the cover not being hermetically closed (and perhaps sometimes left off altogether) allowed the weevil to penetrate, and thus spoil the whole of the bread.

The arrangements of the fittings in the proposed experimental tanks were as follows:—Sketch A shows the upper scuttle for filling, and the



lower one for emptying, closed up and screwed tightly. The upper scuttle turns down to an angle of  $45^{\circ}$  with side flaps turning up (as shown in sketch B), the biscuit falling naturally out of the mouth of the bag into the tank. The lower scuttle, as will be seen, falls down level, and the biscuit is drawn out with a small rake into bags as required, the whole contents of the tank falling down naturally until most

of the upper part of the tank is emptied, when that at the bottom is drawn out by the rake as before. When about to fill the tank, the bottom scuttle is first screwed home tightly and joint puttied up, like the mode of securing an ordinary pane of glass, and after all the bread is put in, the upper scuttle is closed and hermetically sealed in like manner; and, in taking out the bread, it is only necessary to clean out the putty, turn down the lower lid, and take out what is required, when the lid must be again turned up, screwed home, and re-puttied.

The inside of the tanks is coated over with hot lime-wash, fixed with about three-quarters of a pound of coarse sugar to each gallon of wash, which keeps the lime from coming off and forms a good wholesome coating.

As before stated, the three experimental tanks, when completed, were examined, and approved by the Constructors' Department and Superintendent of Victualling. One of the tanks was retained at Deptford, and the others sent to Devonport and Gosport Victualling Yards, where they were filled with the newest bread that could be obtained, and hermetically closed up (as before described), in the presence of the Officers of the yard, the bread being carefully weighed before being put in, and a record kept of the weight.

The tank at Deptford, as well as the one at Devonport, was filled with biscuit only about two or three days old, but at Gosport the *newest* biscuit in store was several weeks old, which was accordingly put into that tank.

The tanks were filled in the summer of 1871, when the moth and weevil were very plentiful, and the experimental tanks were put into the condemned bread store, where large quantities of infected biscuit were stowed in bags, the weevil, moths, and maggots abounding at that season all over the loft, and crawling in and out of the open pores of the biscuit bags, which were kept stowed there, as it arrived from the ships, in order to await the annual sale.

If therefore (as some parties stated) the weevils, maggots, &c., bred naturally in the biscuit when stowed in closed iron cases at a high temperature, there was every opportunity for their so doing in the tanks during the summer weather, but if (as seems most reasonable) the moths and weevils fly about from place to place, and deposit their numerous eggs in the bags of new bread, they have ample opportunity for so doing, as in the store lofts, where the bags of *new* bread are stowed, the windows are usually open for ventilation, and these insects can fly in or out at pleasure, as they undoubtedly do, and thus corrupt, in a short time, the good bread. This was clearly to be seen in opening the Gosport tank, after the twelve months had expired, for, while the tanks at Deptford and Devonport, when opened, had not the slightest sign of insect life (the biscuit with which they were filled being all fresh baked), that at Gosport, where the bread had been lying in bags for some weeks before being put into the tank, showed very clear indications of maggots having crawled over the biscuit, and several live maggots were found, although they seemed in a weak condition, and had in no instance bored into the biscuit. It was, however, very manifest that, for lack of air, the maggots had

not in any case changed into the chrysalis state, nor were there any moths visible, which shows that there is no danger of further propagation, even if the young maggots are formed, after the tanks are hermetically sealed.

I would also observe that at the time of filling the tanks at the Royal William Victualling Yard, Devonport, I took an opportunity of putting, into large tin cases, some of the weevilly biscuit in which were hundreds of these living insects in different stages of existence, also I took from the windows, where the live weevils were crawling and flying about in large numbers, some scores of them and placed them in among the others, putting in a quantity of sound biscuit for them to subsist on, and then hermetically closed them up; on removing the lid of these tin cases after being closed twelve months, *not one* of the weevils was alive, and it would appear that they had not lived long after being closed up, for the weevilly biscuit showed no signs of being more full of holes than when put into the tin, while the sound biscuit was perfectly free from their ravages, as when first put in, plainly showing that weevils will not live if shut in from the air, so that if new biscuit is slightly affected with weevil, if, at once, it is hermetically closed up, it prevents the further injury of the biscuit. It must, however, be carefully arranged to have the biscuit perfectly dry, and thus ensure its freedom from mildew, which is sure to take place if the bread gets damp from any accidental cause before it gets into the tank, but once in the tank, however damp the external atmosphere from foggy or wet weather, steam, &c., it will be perfectly free from its influence, and come out lighter than when it went in; this was specially manifest in all the experimental tanks, where the bread weighed about *one* per cent. lighter than when it was put in.

I would also remark that in the event of a vessel shipping a sea, or of a fire occurring on board requiring water to be largely thrown about, in the vicinity of the bread rooms, when, from smoke or steam, or both combined, the bread, if stored in bags, would be sure to be spoiled, the tanks would effectually keep it safe from injury, except the fire were so fierce as not to be got under; also, if fire should occur, and only a very short time be available for getting out provisions into the boats, one of the iron cases, or smaller tanks may without ceremony be pitched overboard, or, if time permit, be lowered with a rope, as the cases would swim, and the biscuits be taken out at leisure, or the "cases" may be stowed away in the boats, where it could be kept dry for use, however rough the weather may be.

At the time of the opening of the experimental tanks in the presence of the Officers of the yard, a sample of the biscuit was sent to the Admiralty with an elaborate report, which on the whole was considered to be so satisfactory that it was determined to fit out one vessel of each class with these tanks.

It was, however, afterwards considered that some of the smaller class vessels going out to tropical stations would be the best test, and accordingly the "Dart," 570 tons, was so fitted and sailed to the south-east coast of America, in June, 1872; next came the "Frolic,"



592 tons, composite gun boat, fitted at Chatham, which went to China, on her first commission, early in February, 1873, afterwards the "Amethyst" corvette of 1,405 tons, was so fitted at Devonport; also on her first commission, this vessel went to the south-east coast of America and West Coast of Africa, about August, 1873, and lastly came the "Victor Emanuel," of 3,087 tons, which was fitted at Portsmouth as a hospital ship for the troops, which went out to the Ashantee war, her tanks, 16 in number, contained 20,000 lbs. of biscuit. She sailed for the seat of war on the West Coast of Africa, in November, 1873. Other vessels are now in course of being fitted, viz., "Undaunted," frigate, "Diamond," and "Sapphire," corvettes, also "Juno," and "Wolverine," while other vessels are being considered which are intended for the reliefs on foreign stations during the next year.

Satisfactory reports have been received from each of the vessels, as to the condition of the biscuit. The captains of the ships were directed to forward a detailed account of where it was obtained, the date when each of the tanks was filled, and when emptied, together with the condition of the bread on these occasions; the report to be forwarded to their Lordships every six months during the commission.

The first report from Commander Denny, Her Majesty's ship, "Dart," of 22nd May, 1873, after about eleven months' trial, stated "that the biscuit was good, dry, and free from weevil, almost as good as when put into the tanks." The second report from "Dart," 25th May, 1874, said "that the *service* bread stowed in tanks was very good. What was obtained from contractor good, in some cases, but "in others attacked by mildew, but yet *better* than if kept in bags." I may here observe that the remarks respecting the bread obtained from contractors on foreign stations is quite in keeping with the general experience of Officers commanding Her Majesty's ships, respecting the use of this sort of biscuit which is often made of inferior flour, or adulterated with pea-meal, and other deleterious ingredients, added to which it is not dessicated in the very satisfactory manner in which our *service* biscuit is prepared, and hence the great difficulty experienced in preserving this bread; the proposed remedy for this will be treated further on.

The first report from Commander Buckle, Her Majesty's ship "Frolic," China station, 30th June, 1873, stated that "the iron cases keep the bread in excellent preservation and entirely free from damp and decay, not the slightest sign of maggot or weevil having yet been observed," but report also stated that tanks fitted with lids for filling and emptying were best, as the experimental potato cases were too slight and got broken, and had to be thrown overboard."

The second report from "Frolic," dated 31st December, 1873, stated that these cases keep the biscuit in excellent condition, not the slightest sign of decay or weevil has been discovered in any of the biscuit so protected; biscuit which has been eleven months in the ship is as good as when put on board. Mention is also again made of the slight material of which potato cases were made, advising their being not quite filled in future, in order to prevent their bulging out,

also advising that only *half* the bread-room may be filled with cases. This last recommendation, however, is considered not advisable, as it would necessitate about six weeks stock being put into bags, which is double the quantity that is deemed safe so to dispose of, as the weevil, in two or three weeks, in a tropical climate, has been known to get a large hold on the bags of bread exposed to their ravages. A report was received at the Admiralty from "Amethyst," dated 30th June, 1874, stating that the bread-room fitted with hermetically sealed iron tanks, has answered well, and the bread appears to keep in better condition than when stowed in bags in the ordinary manner. A second report from the "Amethyst," was received after more than twelve months' trial, which stated that "the plan has hitherto answered very well, the biscuit received in England being as good now as when put on board." A remark was also appended, "that the process of filling the tanks occupies more time than stowing bread in the ordinary way." This, of course, must of necessity be the case, but is of little moment compared with the advantages of the ship's company being constantly supplied with perfectly sweet and wholesome bread.

A report from Captain Parkin, Her Majesty's ship "Victor Emanuel," dated Hong Kong, 30th November, 1874, arrived at the Admiralty early in the present year, which said that "the tanks have been most successful in preserving the biscuit, notwithstanding the heat and closeness of the atmosphere at Cape Coast Castle, and the various temperatures passed through during the passage to China, the biscuit came out as fresh and sweet as when received from the victualling yard, and perfectly free from insects. The tanks have been removed from the ship, and will be used for storing bread at Hong Kong Victualling Yard. The reason why the tanks have been removed is, that the vessel is brought near the jetty, and soft bread will be used while she remains in that position."

The Paymaster's report from "Victor Emanuel" is to this effect:—"The biscuit was as fresh and sweet as when received from the victualling yard, not the sign of the weevil or any insects. I consider the tanks an excellent arrangement for preserving the biscuit."

It therefore appears clear that, if biscuit thoroughly desiccated as that which is so well manufactured in our victualling yards, is put into tanks and hermetically closed, even in the hurried manner in which that was got on board for the Ashantee expedition, it is perfectly safe from harm, either from heat or moisture; as when the joints of the scuttles are puttied, they are quite water-tight as well as air-tight. Bad smells, therefore, arising from exhalations from bilge water, or other causes on board ship, will not affect the biscuit in any way, neither are those pests of a warm climate—the cockroaches—able to get anything to feed on, as they constantly have when the bread is kept in bags, and they are, therefore, far less likely to propagate. And even in our more temperate climate, where the weevil is seldom seen, it would seem very desirable that the bread should be put into tanks, because the ravages of rats and mice in the open bread-room, when the biscuit is stowed in bags, is something very considerable, and causes large quantities of

it to be annually thrown away, to say nothing of the disagreeable idea often pervading the mind, that large numbers of these vermin are running over the bread, leaving their droppings, &c., to the great disgust of those who are obliged to subsist on the biscuit.

In using the tanks, there will also be a great saving in the quantity and cost of bags, which, when stowed in bulk in the bread-room, rot very fast from damp, &c., while the tanks, if painted on the outside once a year, with white enamel paint, will last twenty or thirty years, for the internal coating of lime and sugar effectually prevents rust in that direction.

With regard to the foreign victualling stations, where biscuit is manufactured on the spot, if the climate is tropical and the bread is left *in bags* for any time after it is fully desiccated, nothing can prevent the weevil and maggot from destroying it, but if put into tanks, of the desired construction, as soon as it is properly desiccated, and then allowed to cool, it may be kept perfectly sweet for years, and can be taken out from the lower scuttle into bags (a few bags of finer texture should, however, be used for this purpose, through the pores of which the weevil could not enter), and the biscuit may then be conveyed on board the ship and immediately put into similar tanks fitted in the bread-room of the ship, and biscuit thus treated will assuredly keep in good condition as long as may be required.

With regard to those foreign stations where the bread is *not* made on the premises, but simply stored, as received from England, I would observe that large quantities of biscuit have been condemned, from time to time, at these places, from the ravages of weevils and maggots, produced from the eggs of the moth. From the valuable report of Mr. Rowsell, Director of Contracts, after personal inspection and from information he obtained on the spot, it appears that at Gibraltar, not long since, 390,000 lbs. of biscuit were condemned in five months, also 19,000 lbs. condemned on board "Hercules."

It has been sometimes customary to send out the biscuit to foreign stations in ordinary water tanks, but they have failed to prevent the maggot from spoiling the bread, because they were not hermetically closed, also casks have been used in many cases, these, from the shrinking of the staves, have either let in the water which happened to fall on them (when all mildewed together) or the weevils being very small, have got in through the joints and destroyed the whole contents, which occurred in the store at Jamaica not long ago, where 27,000 lbs. were condemned as unfit for human food.

To insure success in keeping a stock to meet the wants of the shipping, it will be only necessary to have a good supply of store-tanks (similar to that which has been lately put into the Victualling Yard at Hong Kong, from the "Victor Emanuel," late Hospital ship, specially fitted for Ashantee War); and as to means of transit, the bread can be taken out from England in tanks so constructed as to have shifting lids, the whole size of the top, to be screwed up when filled with bread, and then hermetically closed by using putty in the joint, and afterward pasting over it a strip of calico or Chinese paper. These tanks, which, when full, will contain

20,000 to 30,000 lbs. of bread, can be made to fit into each other when empty, so that about twenty tanks may be brought home again for re-filling, at a mere nominal cost, viz., the tonnage due to the cubic contents of the largest tank, together with the bulk of the covers standing one on the other. The cost, therefore, of returning the "empties," which has been the principal objection to sending the bread out in tanks, or in tin-lined cases, is reduced to a mere trifle, and the cost of sending it out would be more than made up by the entire freedom from condemnations of bread, as heretofore, to say nothing of the comfort and satisfaction of the Officers and crews of Her Majesty's ships, in not having to eat the unwholesome foreign-made bread, nor even to be subject to make use of the otherwise good "service" bread when made loathsome by maggots and weevils.

It should also be observed that the ravages of the weevil in the provision-rooms of Her Majesty's ships, are not altogether confined to the biscuit, for all farinaceous articles of diet, such as flour, oatmeal, pearl-barley, rice, &c., also chocolate, when stored in casks and open cases, are often attacked and destroyed, so that they are condemned and sold at considerable sacrifice; this may be entirely prevented by having the smaller tanks, in which these materials are stored in the issuing room, fitted on a similar principle (although somewhat modified) by having the lower scuttle (which will require opening several times a day), fitted with a strong spring latch to close up tightly on a thin slip of india-rubber, so as not to require to be luted with putty in order to make it air-tight.

I have thus endeavoured shortly to explain the mode which has, to a considerable extent, proved efficacious in preserving the biscuit in Her Majesty's Navy, as well as to point out the further proposed method of supplying the various foreign stations; and, I doubt not, if the scheme be fairly worked, that in a short time the condemnation of biscuit in Her Majesty's Navy (except from accidental causes, over which there is no control) will be a thing rarely known.

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